The American Journal of Surgery

PUBLISHED MONTHLY BY THE AMERICAN JOURNAL OF SURGERY, INC.
49 WEST 45TH STREET, NEW YORK, N. Y.

Editor: THURSTON SCOTT WELTON, M.D., F.A.C.S., NEW YORK

EDITORIAL BOARD

DONALD C. BALFOUR, *Rochester, Minn.*; CARL BECK, *Chicago*; GEO. R. BRIGHTON, *N.Y.*; MEREDITH F. CAMPBELL, *N.Y.*; JAMES T. CASE, *Chicago*; ISIDORE COHN, *N.O.*; W. B. COLEY, *N.Y.*; FREDERICK A. COLLER, *Ann Arbor*; GEORGE W. CRILE, *Clev.*; ELLIOTT C. CUTLER, *Boston*; ROBERT V. DAY, *Los Angeles*; CHARLES A. ELSBERG, *N.Y.*; C. R. G. FORRESTER, *Chicago*; H. DAWSON FURNISS, *N.Y.*; JOHN H. GIBBON, *Phila.*; EMIL GOETSCH, *Brooklyn*; CHARLES A. GORDON, *Brooklyn*; DONALD GUTHRIE, *Sayre, Pa.*; A. E. HERTZLER, *Kansas City*; C. GORDON HEYD, *N.Y.*; LOUIS J. HIRSCHMAN, *Detroit*; J. M. HITZROT, *N.Y.*; FREDERICK C. HOLDEN, *N.Y.*; EMILE F. HOLMAN, *San Francisco*; J. A. HYAMS, *N.Y.*; R. H. JACKSON, *Madison*; JOHN E. JENNINGS, *Brooklyn*; W. L. KELLER, *Washington*; HOWARD A. KELLY, *Baltimore*; T. J. KIRWIN, *N.Y.*; ARTHUR KRIDA, *N.Y.*; A. V. S. LAMBERT, *N.Y.*; H. H. M. LYLE, *N.Y.*; JEROME M. LYNCH, *N.Y.*; URBAN MAES, *N.O.*; HARRISON S. MARTLAND, *Newark, N.J.*; J. TATE MASON, *Seattle*; RUDOLPH MATAS, *N.O.*; ROY D. MCCLURE, *Detroit*; H. C. NAFFZIGER, *San Francisco*; CLARENCE R. O'CROWLEY, *Newark, N.J.*; LOUIS E. PHANEUF, *Boston*; EUGENE H. POOL, *N.Y.*; DOUGLAS QUICK, *N.Y.*; N. P. RATHBUN, *Brooklyn*; HUBERT A. ROYSTER, *Raleigh*; HENRY S. RUTH, *Phila.*; A. C. SCOTT, *Temple Tex.*; M. G. SEELIG, *St. Louis*; J. BENTLEY SQUIER, *N.Y.*; H. J. STANDER, *N.Y.*; GEORGE W. SWIFT, *Seattle*; GRANT E. WARD, *Balt.*; J. H. WOOLSEY, *San Francisco*.
Foreign Collaborators—GREAT BRITAIN—J. H. WATSON, *Burnley*. FRANCE—G. JEANNENEY, *Bordeaux*. ITALY—R. BASTIANELLI, *Rome*.

NEW SERIES, VOLUME XXXII

APRIL TO JUNE

1936

THE AMERICAN JOURNAL OF SURGERY, INC., PUBLISHERS
NEW YORK MCMXXXVI

COPYRIGHT, 1936
BY THE AMERICAN JOURNAL OF SURGERY, INC.
All Rights Reserved

Printed in the United States of America

CONTENTS OF NEW SERIES, VOLUME XXXII

ORIGINAL ARTICLES

Unilateral and Bilateral Hernia	*Charles W. Mayo* *Robert S. Hardwick*	4
Vasectomy for Prevention of Epididymitis in Prostatic Surgery	*Benjamin S. Abeshouse*	8
Experimental Studies of Bacterial Cholecystitis	*Hans G. Aronsohn*	18
Rotary Dislocation of Atlas on Axis	*J. O. Rankin*	27
Sciatic Neuralgia Controlled by Intraspinal (Subarachnoid) Injections of Ethyl Alcohol	*C. W. Goff*	37
Intraperitoneal Use of Amniotic Fluid to Promote Smoother Postoperative Convalescence	*J. Randolph Gepfert*	40
Treatment of Sprains by Interligamentary Injection of Novocaine	*René Leriche* *G. Arnulf*	45
Fascia Lata Repair of Sliding Hernias	*Alfred H. Iason*	48
Cutting Prethyroid Muscles for Exposure in Thyroidectomy	*Howard M. Clute*	51
Functions of Mediotarsal Joint	*John Joseph Nutt*	53
Substernal Thyroid	*Robert F. Sharer*	56
Evisceration and Avulsion of Abdominal Wounds	*S. Thomas Glasser*	63
Subperitoneal Decortication in Gall-Bladder Disease	*D. Philip MacGuire*	77
Treatment of Acute Head Injuries	*Jewett V. Reed*	79
Diagnosis and Treatment of Ectopic (Tubal) Pregnancy	*William H. Johnston*	84
Diagnosis and Treatment of Cancer of Pelvic Colon and Rectum	*J. W. Thompson* *H. W. Soper*	90
Repair of Certain Type of Hernia: Hernial Sac Used as Suture Material	*Chester L. Davidson*	96
Episiotomy under Local Anesthesia	*Sidney Vernon* .	100
Peritoneal Sutures in Narath and Schanbauer's Modification of Talma's Operation	*Gustav Zechel* . .	101
Podalic Version	*Samuel S. Fosenfeld*	103
Fatalities in Phrenic Nerve Surgery	*Edwin J. Grace* *Edward H. Linnehan*	105
Partial Gigantism: Overgrowth and Asymmetry of Bones and Skeletal Muscle	*Henry Bascom Thomas*	108
Hyperparathyroidism with von Recklinghausen's Osteitis Fibrosa Cystica Generalisata and Hypopituitarism	*Gertrude M. Johnson*	113
Benign Bone Cyst	*Robert D. Fairchild*	126
Acute Puerperal Inversion	*J. Bay Jacobs*	130
Acute Dilatation of Stomach	*H. Jackson King*	135
Gangrene of Lung	*J. K. Donaldson* *Edgar McPeak*	139
Voluntary Dislocation of Neck	*Ernest A. Brav*	144
Aberrant Lingual Thyroid	*Herman Rubin*	150

Intrascrotal Lipoma	*Fedor L. Senger* *John J. Bottone*	154
Placenta Accreta	*Michele Tomaiuoli*	156
Reversed Colles Fracture: Closed Reduction	*Sidney S. Gaynor*	161
Pancreatic Congestion Limited to Cauded Portion	*George Ferré*	162
Two Interesting Cases of Fracture of Sternum	*W. K. Jennings*	164
Gallstone Obstruction of Bowel	*A. A. Skemp.* *E. G. Travnicek*	166
Myxosarcoma of Prostate	*Wm. Rosenberg*	169
Struma Lymphomatosa (Hashimoto)	*D. Henry Poer* *T. C. Davison* *E. L. Bishop.*	172
Acute Intussusception in Early Weeks of Life	*J. M. Mora* *L. J. Aries*	176
Foreign Body in Urinary Bladder.	*O. P. Mauterer*	178
Fracture Dislocation of Sacroiliac Joint	*Walter G. Stern*	179
Portable Fracture Reduction Apparatus	*John T. Bate.*	180
Suspension for Leg Casts	*Voigt Mooney*	186
Proctoscope Adapter for Otoscope Battery Handles	*William Lieberman*	187
Speculum Matricis by James Wolveridge.	*Edgar F. Kiser*	188
Postoperative Atelectasis	*Frederick Christopher* *James M. Shaffer*	197
Diaphragmatic Hernia	*P. E. Truesdale*	204
Regional Anesthesia.	*Henry S. Ruth* *John A. Stiles*	217
Renal Arteriography	*R. B. Henline* *S. W. Moore.*	222
Simplified Local Vaginal Hysterectomy	*A. Sampolinski*	230
Single Incision, Transabdominal, Extraperitoneal Approach to Lumbar Ganglia.	*Clarence E. Rees.*	234
Low Mortality of Early Operation for Perforated Gastric and Duodenal Ulcer	*Benjamin T. Tilton.*	238
Delayed Operation in Acute Cholecystitis	*Hugh L. Bass* *Clarence E. Bird.*	241
Non-padded Plaster Cast for Lower Extremity	*R. A. Griswold*	247
Infections of Parotid Gland	*William H. Hobbs* *Hyman Sneierson*	258
Prevention of Gas Pains	*Louis E. Mahoney*	272
Fractures of Shaft and Neck of Femur	*Irwin E. Siris* *C. Joseph Delaney*	277
Etiology of Cholelithiasis	*H. A. Petersen*	291
Contributing Factors of Peritoneal Infection in Closed Incisions of Abdomen.	*R. M. Harbin*	298
Anorectal Fistula; Anatomical Considerations and Treatment	*R. V. Gorsch.*	302
Modern Method for Prevention of Postoperative Distention	*William R. Levis* *E. L. Axelman*	308
Protein Metabolism; Disturbances under Conditions of Shock and Surgical Interference	*A. Lurje*	313

Frost-Bite	*Theodore Kaplan*	318
Autohemotransfusion in Preventing Postoperative Lung Complications	*Michael W. Mettenleiter*	321
Application of Adhesive Plaster	*Gustav Zechel*	324
Appendicitis Complicating Pregnancy and Labor	*James F. Norton.* and *John N. Connell.*	325
Favorable Effect of *X*-Ray on Unusual Bladder Tumor	*John K. Ormond*	333
Leukoplakia of Kidney Pelvis and Ureter	*William N. Taylor*	335
Ninety-Seven Pound Fibromyoma Uteri	*W. S. Wheeling* and *J. A. Orris*	343
Hypertension, Obesity, Virilism and Hirsutism Associated with Adrenal Cortical Carcinoma	*Richard Joseph White*	347
Abnormalities of Rotation of Midgut	*H. H. Donaldson*	352
Hemorrhagic Infraction of Cecum	*I. B. Harris*, *Frank E. Hamilton* and *George E. Peters*	357
Spontaneous Rupture of Uterus	*Oscar H. Bloom*	363
Wilm's Tumor	*David N. Ingram*	366
Prolapse of Rectum Caused by Extraperitoneal Cyst of Wolffian Body Origin	*George I. Israel*	369
Traumatic Rupture of Penis	*Theodore R. Fetter* and *Edward Gartman*	371
Acute Osteomyelitis of Patella	*Mario E. Stella*	373
Diverticulitis of Ascending Colon Simulating Acute Appendicitis	*Joseph A. Visconti*	376
Intestinal Needles	*G. A. Hendon*	377
Silver Staple Clamp	*Lester R. Whitaker*	379
Proctoscopic Attachment for Operating Room Table	*R. Russell Best*	381
Tobias Smollett	*Carl Beck*	383
Tumors of Head and Neck	*Arthur F. Holding*	393
Modern Treatment of Carcinoma of Uterus	*Arthur M. Dickinson*	395
Cancer of Rectum	*Walter F. Preusser*	399
Tumor Clinic and Pathologist	*John J. Clemmer*	401
Alternative Methods for Restoring Gastrointestinal Continuity after Gastric Resection for Carcinoma	*Donald C. Balfour*	405
Rectal Administration of Evipal Soluble	*James T. Gwathmey*	411
Electrosurgical Obliteration of Gall Bladder without Drainage	*Max Thorek*	417
Operative Mortality of "Inoperable" Carcinoma of Colon and Rectum	*Jerome M. Lynch* and *G. Johnson Hamilton*	435
Organization of Transfusion Service and Blood Donors Bureau for Average Hospital	*Hayes E. Martin* and *Ruthe Whyte.*	439
Glove Flap Method of Dorsal Hand Repair	*Gerald Brown O'Connor*	445
Skull Fractures	*Edwin G. Ramsdell*	448
Descriptive Terms for Abdominal Electrosurgery	*Lester R. Whitaker*	452
Effect of Head Injury on Hearing and Orientation	*Mark J. Gottlieb.*	455

Edema of Upper Extremity in Carcinoma of Mammary Gland	*John J. Gilbride*	463
Treatment of Carbuncle with Short Wave Diathermy and Cautery Puncture	*Morris Fellman*	467
Acute Appendicitis—Report of 757 Operated Cases	*R. M. Pool*	469
Adequate Surgical Masking: Problem and Solution	*Edward G. Waters*	474
Strangulated Inguinal Hernias in Premature Infants	*Samuel E. L. Goldberg* *Alwin C. Rambar*	478
Biopsy in Proctology	*R. V. Gorsch*	483
Treatment of Acute Pancreatic Necrosis	*Lewis F. Smead*	487
Importance of Prickle Cell Layer in Skin Grafting	*Edwin J. Grace*	498
Successful Operation for Mesenteric Vascular Occlusion	*W. S. Brown*	499
Spontaneous Perforation of Carcinoma of Stomach	*Alexander Brunschwig* *Theodore E. Heinz*	508
Mucocele of Appendix	*Thomas E. Jones* *Morris G. Carmody*	511
Recurrent Intestinal Obstruction Due to Gallstone	*William H. Mast*	516
Ischemic Necrosis from Ice Bag "Burn"	*George H. Bunch*	519
Posttraumatic Thrombosis of Internal Carotid Artery	*John A. Caldwell*	522
Calcified Deposits in Subscapularis Tendon	*C. Edward Thompson* *Charles W. McLaughlin, Jr.*	524
Metastatic Tumors of Heart	*J. K. Miller*	527
Traumatic Rhabdomyosarcoma of Thigh	*Herman Charache*	530
Peripheral Vascular Disease with Gangrene of Extremities	*R. J. Dittrich*	533
Acute Edema of Vulva	*Donald J. Thorp* *C. P. Wangeman*	538
Postoperative Backache; Cause and Management by Improved Hospital Bed	*J. K. Berman*	541
Fascial Suture Clamp	*Hall G. Holder*	544
Spontaneous Version at Term	*Palmer Findley*	545

The American Journal of Surgery

is the leading independent surgical Journal. It publishes many papers read before the outstanding Surgical Societies, but it is *not* "the official organ" of any organization. Every manuscript is selected by the editors, as worthy of publication—nothing is published because "it was read at the meeting."

NEW SERIES, VOL. XXXII APRIL, 1936 No. 1

EDITORIAL BOARD

Editor:

THURSTON SCOTT WELTON

New York

D. C. Balfour	*Rochester, Minn.*
Carl Beck	*Chicago*
Geo. R. Brighton	*New York*
M. F. Campbell	*New York*
James T. Case	*Chicago*
Isidore Cohn	*New Orleans*
W. B. Coley	*New York*
F. A. Coller	*Ann Arbor*
George W. Crile	*Cleveland*
E. C. Cutler	*Boston*
R. V. Day	*Los Angeles*
Charles A. Elsberg	*New York*
C. R. G. Forrester	*Chicago*
H. Dawson Furniss	*New York*
J. H. Gibbon	*Philadelphia*
Emil Goetsch	*Brooklyn*
Charles A. Gordon	*Brooklyn*
Donald Guthrie	*Sayre, Pa.*
A. E. Hertzler	*Kansas City*
C. Gordon Heyd	*New York*
Louis J. Hirschman	*Detroit*
James M. Hitzrot	*New York*
F. C. Holden	*New York*
Emile F. Holman	*San Francisco*
J. A. Hyams	*New York*
R. H. Jackson	*Madison*
John E. Jennings	*Brooklyn*
W. L. Keller	*Washington, D.C.*
H. A. Kelly	*Baltimore*
T. J. Kirwin	*New York*
Arthur Krida	*New York*
A. V. S. Lambert	*New York*
H. H. M. Lyle	*New York*
Jerome M. Lynch	*New York*
Urban Maes	*New Orleans*
Harrison S. Martland	*Newark*
J. Tate Mason	*Seattle*
R. Matas	*New Orleans*
Roy D. McClure	*Detroit*
H. C. Naffziger	*San Francisco*
C. R. O'Crowley	*Newark*
Louis E. Phaneuf	*Boston*
Eugene H. Pool	*New York*
Douglas Quick	*New York*
N. P. Rathbun	*Brooklyn*
H. A. Royster	*Raleigh*
A. C. Scott	*Temple*
M. G. Seelig	*St. Louis*
J. Bentley Squier	*New York*
H. J. Stander	*New York*
George W. Swift	*Seattle*
Grant E. Ward	*Baltimore*
J. H. Woolsey	*San Francisco*

EDITORIAL

NECESSITY FOR A CHAIR OF TRAUMATIC SURGERY IN ALL MEDICAL SCHOOLS

AS one of the members of the editorial board, I have been requested by our Editor to give an expression of my ideas on this subject.

I will attempt, as clearly as possible, to cover the subject without becoming personal. Undoubtedly some of my statements will not be acceptable to everybody, but I am only expressing my viewpoint of the situation and after considerable discussion with others specializing along the same lines.

Thirty-three years ago I started practicing Industrial Surgery, long before occupational diseases were ever considered; even compensation laws in the different States were not established, and everything handled was under Common Law practice. Our education in school along industrial lines, now called Traumatic Surgery was extremely limited and inadequate. Our courses in handling fractures, nerve injuries and dislocations were so inadequate that we had to establish an office and attempt to do this work as best we could, in many instances I am sorry to say, at the expense of the patient. Our solutions for hands and instruments, at a fair guess, consisted of twenty drops of carbolic acid to a pan of water; steam sterilization was in its infancy.

There was no surgical manual to follow, nor were there any books on the subject. In handling any traumatic case, we had to use our judgment according to our individual initiative. *X*-rays were not in use; we had to decide by manipulation, sense of touch, plus plenty of common sense, whether we were producing a good result or not.

In retrospect, some of the results we obtained are surprising, though some of the bad ones were somewhat deplorable.

The few of us who persisted in this work were forced to develop new ways to help humanity, despite adverse

criticism by the Medical Society. More than once in those early days, I was haled before the Ethical Relations Committee of my city, for apparently fracturing in various ways the "Oath of Aesculapius." This Committee composed of men who were supposed to be my superiors, at one time consisted of a gynecologist and two general practitioners. In fact, I was regarded as a rank outsider only to be tolerated, possessing very suspicious principles and devoid of sentiment or character.

Since then there has been a reversal of the entire situation, which I have watched with considerable amusement and interest.

Corporations today have their private medical set up and employ the best men they can get and the best men are only too glad to accept the positions offered. The insurance companies are doing likewise. The American College of Surgeons has accepted Traumatic Surgery as a separate section.

The most interesting clinics at present are Traumatic Clinics and some of the finest men I know throughout the country are willing to be found at these meetings. In fact, many of them *now represent* these companies in one capacity or another. But beyond that we have not progressed. To the best of my knowledge there is not a recognized Medical School in the country that is teaching, or has a Chair of Traumatic Surgery filled by a man who through years of hard knocks and training along this particular line, teaches the subject.

I do not mean to infer that the students do not receive some lectures on the handling of fractures, etc., "Yes," they admit to me in the different hospitals of which I am on the Attending Staff, they get "something" as they express it, but admit it is very scanty. When I see a Taylor spine brace being put upside down on a man's back, it is just too bad and in my estimation does not speak well for the Traumatic Curriculum of that institution.

Likewise, Thomas splints, abduction splints, in fact many things along this line are not taught today and in my estimation it is time the schools recognized this situation and improved it.

In view of my rather definite statements in this respect, I made inquiries from three recent graduates of three recognized Class A medical schools and the answers were the same, "a decidedly inadequate traumatic course" and some of their criticisms are far from complimentary.

"Traumatic Surgery" *can not be taught by a general practitioner* but should be taught by one who has been, and is devoting his entire time to the subject, and recognized as such, and can convey his knowledge to his listeners.

Some five years ago a meeting was called by Dr. Franklin Martin, of the American College of Surgeons, which ten or fifteen experienced traumatic surgeons were asked to attend. The purpose was to determine wherein the trouble lay for the young doctor of that period, the schools or elsewhere.

I was called first; I expressed myself very bluntly in regard to the lack of teaching of Traumatic Surgery, as well as the Compensation Law, which should come under Medical Jurisprudence, and cited some very glaring examples. I was supported by every Traumatic Surgeon in the room.

It was a very disconcerting situation to the listeners, to say the least. The deans of three Medical Universities were present. The question was put to one of them; the answer, "Well, you know it is pretty hard to teach an old dog new tricks," was about the weakest explanation I have ever heard.

We older men have had to improve our knowledge of Traumatic Surgery in any way possible, some of us going abroad to see how the other fellows over there do it; this I have done repeatedly.

After visiting Böhler, in Vienna, some ten years ago, I was the first man in Chicago to advocate his methods. I was unpleasantly criticized but today his methods are being used all over the city and

to some extent in many other cities but not in the Medical Schools.

A man who teaches this subject in any of the larger medical universities should by virtue of his years of hard work, real experience, a proved reputation and ability, be the logical one to be appointed, providing it can be done; but with the local situation of competition, jealousy, lack of cooperation and understanding in each university, I question the success of any Dean of any University, unless he has the courage of his convictions.

Dr. Hart E. Fisher, Chief Surgeon of the Chicago Rapid Transit Company, published in the June, 1935 issue of "Industrial Medicine," an excellent teaching set up which could be adopted.

The University that establishes a real Chair of this nature, appointing a well trained Traumatic Surgeon of years of experience, will be surprised at the number of students who will attend that University. I say this because I am being approached continuously by young men asking what University gives a good Traumatic course. Likewise, it might interest the same Universities that practicing physicians who are located close to automobile or traffic highways, are having to meet the demands of more intelligent handling of bodily injuries and they, too, are trying to find places to go for such a course.

In my opinion it is time the Medical Schools woke up to the seriousness of this situation and the present lack of teaching facilities in Traumatic Surgery.

None of us are going to live forever and our places should be filled by capable and competently trained men who will follow us.

There is no doubt that any of us older men in the larger cities of our country, capable of teaching this subject, would be willing to do so provided we were not hampered by the petty politics or iconoclasm of the universities.

C. R. G. Forrester.

Subscribers to The American Journal of Surgery *visiting New York City are invited to make the office of the publishers (The American Journal of Surgery, Inc., 49 West 45th Street, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices.*

UNILATERAL AND BILATERAL HERNIA

COMPARATIVE STUDY OF POSTOPERATIVE COMPLICATIONS AND FACTORS CONCERNED*

CHARLES W. MAYO, M.D., AND ROBERT S. HARDWICK, M.D.

Division of Surgery, The Mayo Clinic — Fellow in Surgery, The Mayo Foundation

ROCHESTER, MINNESOTA

THIS study was undertaken primarily for the purpose of determining whether there was any increased risk to the patient in the performance of bilateral over unilateral inguinal herniotomy. It resolved into an analysis of the postoperative complications and an attempt to ascertain the etiologic factors concerned. It was felt that information might be obtained which would aid in determining the value of thyroid extract as a prophylactic agent against embolism.

The total number of cases studied was 1066, comprising a consecutive series of 522 bilateral and 544 unilateral herniotomies. Of the total number of patients, only 71, or 6.6 per cent, were females.

Although various types of surgical procedures are employed in the treatment of inguinal hernias they are sufficiently standardized to give a reasonable basis for comparison, and it can be said that there is approximately twice as much surgical trauma, and the duration of operation and anesthesia is approximately twice as long in bilateral herniotomy as in unilateral herniotomy.

Right inguinal hernia occurs more frequently than left inguinal hernia, but there is no significant difference between the two in the risk of operative treatment, as far as complications are concerned. An interesting point was noted that, regardless of the side on which operation had been performed, phlebitis occurred much more frequently in the left leg.

We shall first concern ourselves with those complications that could be of embolic origin or etiologically be referred to the vascular system. When direct proof of this was lacking the embolic nature of the complication has been assumed on clinical diagnosis, in many instances supplemented by the roentgenologic findings. Phlebitis has been diagnosed on the criteria advocated by Brown: tenderness along the course of the vein, edema, and a constitutional reaction.

TABLE 1
COMPARATIVE STUDY OF COMPLICATIONS FOLLOWING HERNIOTOMY

Complications (Group A)	Bilateral	Unilateral
Pneumonia	24*	9†
Sudden death	3	0
Pleurisy	3	2
Embolic pneumonia and phlebitis	2	2
Cerebral embolism and phlebitis	1	0
Phlebitis	11	10
Total	44	23

* In 10 of these cases pneumonia was of embolic origin; in 7 others proof of such origin was not obtained.

† In 4 of these cases pneumonia was of embolic origin; in 3 others proof of this was not obtained.

In Table 1, Group A, it will be seen that there were 24 cases of pneumonia in the bilateral group of 522 operations and 9 in the unilateral group of 544, which is approximately three times as many for bilateral as for unilateral herniotomy. Clinical evidence showed that in 10 cases in the bilateral group and in 4 in the unilateral group pneumonia began with infarction. In some instances the roentgenologic

* Read before the meeting of the Nevada State Medical Association, Elko, Nevada, October 25 to 26, 1935.

findings corroborated the clinical findings. Roentgenograms of the thorax of a patient who is in bed are not wholly satisfactory and the clinical evidence is more reliable in the early case of pneumonia. Although it is probable that the complication of pleurisy is to be explained on another basis, it is possible that it may be embolic, resulting from an infarct near the outer surface of the lung.

There were 11 cases of frank phlebitis in the bilateral group of herniotomies and 10 in the unilateral group. In 2 cases in each group phlebitis was associated with an unquestioned embolic pneumonia and in one case in the bilateral group with cerebral embolism. Although there were no sudden deaths from embolism in cases in which single inguinal hernias were repaired, there were 3 in cases in which bilateral herniotomy was performed.

Altogether there were approximately twice as many complications of proved vascular origin in the bilateral group as in the unilateral group. Those complications which did not seem to be connected with a faulty vascular system were grouped under the heading of miscellaneous. Some of these complications were serious but most are better classified as annoying. Principal among these were epididymitis, orchitis, cystitis, prostatitis, parotitis and infected wounds. There were about 12 of these various complications in each group.

There is a sound dictum in surgery that no patient should be advised to undergo operation, no matter how simple or serious unless, in the estimation of the surgeon, the benefits to be derived outweigh the risk involved. A review of these cases discloses that in a great many instances in which the risk seemed to be increased, complication did not ensue, most probably because of increased precautions being taken, "forewarned being forearmed." While complications did develop in some cases in which the risk had seemed to be increased, the majority of these complications developed in cases in which with present knowledge, it was impossible to predict the degree of danger from operation.

Is sex an index? McCartney, as well as others, has stated that the female is more subject to postoperative vascular accidents than the male. This seemed to be substantiated, although not markedly so, in our series.

Excluding one patient who was in the eighth decade of life, there was no great difference in the age distribution for each respective group. The patient's weight as a factor in the risk in the unilateral group seemed to be of little significance, but in the bilateral group there was a definite increase in the percentage of risk for patients weighing more than 190 pounds (86.2 kg.). This is not new, however, as obesity has long been recognized as increasing the hazard in any type of case.

We will not take the time here to review those conditions which obviously may complicate any surgical procedure, but rather, will pass to a consideration of possible factors which may be encountered at operation:

Table II
COMPARATIVE STUDY OF TYPES OF ANESTHESIA

Anesthesia	Bilateral			Unilateral		
	Total cases	Complications	Per cent	Total cases	Complications	Per cent
Spinal	181	15	8.2	51	3	5.8
Inhalation	174	21	12.0	228	12	5.2
Regional	94	5	5.3	188	6	3.1
Spinal and inhalation	19	4	21.6	3	0	0
Regional and inhalation	54	4	7.4	71	5	7.0
Intravenous sodium amytal	0	..		2	0	
Rectal sodium amytal and inhalation	0	..		1	0	
Total	522	49		544	26	

Anesthesia has advanced remarkably in the last few years and progress has been made by adherence to the watchword, "Suit the anesthesia to the patient, not the patient to the anesthesia." Despite reports to the contrary, in this series there seemed to be a relationship between the type of anesthesia and the complications (Table II); regional anesthesia had the least, regional

and inhalation next, and spinal next when it was not supplemented by inhalation anesthesia. When this combination became necessary, the complications were almost tripled over those cases in which spinal anesthesia alone was used, as far as bilateral herniotomy is concerned. In cases in which unilateral herniotomy was performed, the significance of the type of anesthesia is not so apparent although regional anesthesia is still accompanied by a lower percentage of complications.

In considering the duration of operation as a factor there are various angles which must be kept in mind. If the operation extended for two hours, spinal anesthesia was supplemented by inhalation anesthesia with a resultant increase in complications. This time factor is of no real significance in the unilateral group, but it is of very definite significance in the bilateral group, in which complications were double those for unilateral herniotomy. Trauma may be an additional factor; generally speaking, there is twice as much injury in bilateral herniotomy as in unilateral herniotomy.

In regard to the postoperative course, interest was centered especially on pulse rate, blood pressure and temperature. Detailed study of daily pulse rates failed to verify the opinion that rapid pulse is a factor of safety, which is assumed as a physiologic basis for administering thyroid extract as a prophylaxis against embolism. The average acceleration of the pulse rate was slightly higher in the bilateral group than in the unilateral group. In practically all the cases in the bilateral group in which complications developed there was elevation of the pulse rate, whereas in the unilateral group an increased rate was present in only about two-thirds of the cases. Approximately the same high percentage of increased pulse rates for the first three days following operation was found in cases in which complications were present; after the third day the rate for both groups was within the same range.

The blood pressure immediately following operation averaged slightly lower for the bilateral group than for the unilateral group, but no appreciable difference could be detected for either group, as between cases in which complications occurred and those in which they did not. The statistics derived from observations of the temperature were of no significance up to the time the complication developed.

Some years ago Walters advocated the use of thyroid extract, administered postoperatively in doses of 2 grains (0.12 gm.) three times a day, as a prophylactic measure against embolism. It was applicable particularly to cases in which the pulse rate was not accelerated or low, the hypothesis being that decreased rapidity of the heart's action and slowing of the entire blood stream is conducive to pathologic thrombosis, and that thyroid extract is physiologically suitable for elevating the pulse rate. Evidence that such a theory has foundation is seen in the small number of emboli following operations on patients affected with thyrotoxicosis, and in cases in which infection develops, a rapid pulse rate seeming to serve as a factor of safety.

A review of the situation with regard to the value of thyroid extract in this series of cases demonstrates that there is no significant advantage in administering it to prevent either general complications or complications which are or may be specifically of an embolic nature. One hundred fifty-four patients with bilateral hernia received thyroid extract, 368 did not receive it; 158 with unilateral hernia received it and 386 did not.

Inasmuch as thyroid extract is usually not given prior to the third postoperative day, if no good is accomplished certainly no harm is done, and if physiologic reasons for administering the drug are sound, then it is possible that a change in the time it is administered may give the desired results. It is well recognized that many people are somewhat deficient in thyroid in degrees often too small to be readily recognized. It is possible that a low early morning temperature may be the index to this type of case. For this reason we suggest that if

thyroid extract is to be used, it be given before operation and by rectum immediately following operation, so that the benefit, if any, may be obtained early rather than late. We have followed this procedure in a series too small as yet for the results to be evaluated.

It is of interest to note that of the total of 1066 patients, 161 were catheterized following operation. Of these, 157 were unable to void, and the remaining 4 were catheterized for residual urine at some time during the postoperative convalescence. The number of complications in relation to the number of catheterizations is startling. Approximately one-quarter of those with bilateral hernia were catheterized, and there were twice as many complications among those who were catheterized. One-tenth of the patients with unilateral hernia were catheterized, a little more than twice as many complications occurring among these patients as among those in the group who did not require catheterization. In other words when a patient who has undergone herniotomy requires catheterization, one should be on guard against the possibility of complications developing.

SUMMARY AND CONCLUSIONS

From a comparative analysis of the complications following operation in 522 cases of bilateral hernia and in 544 cases of unilateral hernia, it was found that there was a definitely increased risk in bilateral herniotomy performed in one stage over unilateral herniotomy. It was also found that regional anesthesia seemed to carry a lower incidence of complications than other types of anesthesia; that spinal anesthesia, when it had to be supplemented by inhalation anesthesia, was accompanied by a high incidence of complications, indicating that spinal anesthesia had best not be employed when a protracted surgical procedure for bilateral hernia is anticipated; and that the administration of thyroid extract as a prophylaxis against complications of an embolic nature administered as at present was of no value in this series of cases.

The question might legitimately be asked whether it is not just as satisfactory to repair a bilateral hernia in one stage since approximately the same risk must be taken in repairing a bilateral hernia whether it is done in one stage or two. We think that the answer to this is that if one repairs one side, accepting a known smaller risk, then if complications should develop they would indicate what must be anticipated in repair of the opposite side. Then, too, in performing the operation in two stages there is less risk of pulmonary complications because of prolonged anesthesia, often necessary in performing bilateral herniotomy in one stage.

VASECTOMY FOR PREVENTION OF EPIDIDYMITIS IN PROSTATIC SURGERY*

REPORT OF 208 CASES

BENJAMIN S. ABESHOUSE, M.D.

Attending Urologist, Mt. Sinai Hospital; Instructor in Genitourinary Pathology, University of Maryland School of Medicine

BALTIMORE

A PRESENTATION of the method and results obtained by partial vasectomy in the prevention of epididymitis in prostatic surgery seems opportune at this time for two reasons: (1) Epididymitis is an unpleasant and often serious complication in the preoperative and postoperative course of the prostatic patient; and (2) There has been a revival of interest in the incidence of postoperative epididymitis as a result of the relatively frequent occurrence following the transurethral method of treatment of prostatic obstruction in non-vasectomized patients.

Statistics show a marked variance in the incidence of pre and postoperative epididymitis in prostatic patients who have not been treated by preliminary vasoligation or vasectomy. In various urological clinics the percentage of complicating epididymitis in the non-vasectomized patients ranged from 6 per cent (Rathbun) to 82 per cent (White). In 1930 Crabtree and Brodney collected 1624 prostatectomies performed without vasoligation or vasectomy (excluding the series reported by Rathbun and White) and found that the average incidence of epididymitis occurring during the period of hospitalization was 21.6 per cent. Crockett and Washburn studied the progress of the prostatic patient after discharge from the hospital and found that in a series of 100 cases there were 16 of epididymitis (13 unilateral; 1 bilateral; 2 with abscess formation).

The consensus of opinion is that the incidence is greater after the suprapubic than the perineal operation. Aschner reviewed a series of 277 prostatectomies and observed that the incidence of postoperative epididymitis was greater in the two stage suprapubic prostatectomy (15 per cent) than the one stage operation (10 per cent). The incidence of preoperative epididymitis in the two stage operation was 5 per cent thus making a total of 20 per cent for the two stage prostatectomy. In a series of 50 suprapubic prostatectomies, White did not encounter a single case of postoperative epididymitis following the two stage operation, whereas epididymitis occurred in 86 per cent of the cases where a one stage operation was employed. In this series of 1049 perineal prostatectomies, Yound found that 20 per cent developed an epididymitis.

It is generally accepted that epididymitis occurs less frequently after transurethral resection of prostate than after suprapubic or perineal operation. The incidence of epididymitis following the various transurethral methods of treatment of prostatic obstruction varies from 3 to 11 per cent with an average of about 6 per cent. In 1928 Collings reported two cases of epididymitis following electrotome excision of the prostatic bar in 30 cases, an incidence of 6.6 per cent. Engel reviewed 64 cases of transurethral operation for relief of bladder neck obstruction treated by Caulk's method (48 cases) and Stern-Davis method (16 cases) and found 4 cases of epididymitis (6.1 per cent). Haines observed 7 cases of epididymitis in a series of 27 prostatic resections (25.5 per cent) and in a series of 19 cases Dorman

* From the Urological Service, Sinai Hospital, Baltimore, Maryland.

reported 3 cases of epididymitis (7.4 per cent). Ballinger, Elder and McDonald reviewed 82 cases, 14 of which had preliminary vasoligation and observed 9 cases of epididymitis (11 per cent). In an analysis of 200 resections on 175 patients, Alcock noted 6 cases of epididymitis in 93 resections without vasectomy (6.5 per cent). In a recent report of 616 cases, Davis mentioned 19 cases of postoperative epididymitis (3.08 per cent).

Vasoligation and Vasectomy. Vasectomy as a preliminary to prostatectomy received its initial impetus in this country with a report of a series of 25 cases by Goldstein at the meeting of the American Urological Association in 1926. This was soon followed by reports on the closed method of vasoligation by Alyea and Colston in 1928. Other contributions emphasizing the advantages of ligation and resection of the vas in the prevention of epididymitis in prostatic surgery were made subsequently by McKay 1928, Meltzer 1928, O'Neil 1929, Crabtree and Brodney 1930, Davis 1933 and others.

Several different types of operations have been proposed for ligation of the vas. In 1904 Proust reported the routine ligation of the vas above the prostate in his perineal operation. In 1909 Albarran and in 1932 Burgess advocated ligation of the vas through a small incision in each groin. In 1932 Sarnoff modified this procedure by exposing and ligating the vas in each groin through a suprapubic incision at the time of suprapubic cystotomy or prostatectomy. Ligation of the vas through a small incision in the scrotum was described by Haberer in 1912 and Morson in 1923. In 1931 Keyes advocated scrotal ligation of the severed ends of the vas side by side like a double barreled gun without bringing the stumps to the skin surface, and others have proposed implanting the severed ends in the skin. In the closed method of vasoligation of Alyea and Colston, the vas is palpated through the scrotal skin and grasped with an Allis clamp or special Alyea clamp. A silkworm suture is passed through the scrotal skin under the vas and is tied on the skin surface. Davis had recently modified this technique by employing a No. 2 chromic catgut ligature inserted through the scrotal skin beneath the vas and then passed in a reverse direction through the same needle openings. This modification eliminates the skin necrosis and ulceration which frequently occurs with the Alyea-Colston method. The term, vasectomy, as employed in this paper implies a partial resection of the vas and is essentially a modification of the open method of vasoligation wherein a small portion, at least one cm., of the vas and its sheath are removed and the cut ends of the vas are ligated with chromic catgut.

Experimental studies show conclusively that simple ligation by the closed method and simple section with ligation of the severed ends by the open methods are insufficient protection against the development of an epididymitis. Rolnick studied the regeneration of the vas in animals and found that after simple ligation with absorbable material and in certain cases with non-absorbable material the vas regenerated and reestablished its lumen as early as the twenty-second postoperative day. He also found that occlusion of the lumen of the vas does not take place when the vas is sutured into the skin or is exposed outside of the skin for a number of days.

Clinical experience also emphasizes the inefficacy of vasoligation in the prevention of epididymitis. According to Crabtree and Brodney, cases have been reported wherein spermatozoa were found in the seminal vesicles or in their secretion within three months following ligation. Alyea found that 10 per cent of the patients who had a simple ligation at the time of prostatectomy developed an epididymitis, less than half of the average occurrence without vasoligation or vasectomy. In a series of 35 cases reported by McKay in which vasoligation by the Alyea method was performed, 5 patients, or 15 per cent, developed an epididymitis shortly after the removal of the ligature. Reed and

Morgan performed vasoligation following the Alyea method in 6 cases and 3, or 50 per cent, of these patients developed



Fig. 1. Technique of vasectomy: (A) skin incision; (B) palpation of vas through scrotal skin prior to making incision; and (C) exposure of spermatic cord and identification of vas which is grasped with an Allis clamp.

epididymitis in seven to twenty-one days postoperatively. Pugh reported 125 cases of transurethral resection in which epididymitis occurred in 17 cases, 13.6 per cent, in spite of bilateral vasoligation. In a discussion of Reed and Morgan's article, Ravich and McKenna both discarded vasoligation because the incidence of epididymitis did not appear to be influenced by this procedure and the percentage was practically the same as in their unligated cases. On the other hand, since 1922 Burgess has employed the open method of bilateral vasoligation routinely in 177 prostatectomies and has not had a single case of postoperative epididymitis, whereas the previous incidence was 22 per cent.

The effectiveness of vasectomy in preventing postoperative epididymitis is borne out by the finding of Crabtree and Brodney. In an analysis of 514 cases in which vasectomy was performed, they found only 8 cases, 1.5 per cent, of postoperative epididymitis. The reduction in the incidence of postoperative epididymitis becomes more striking when compared with an incidence of 21.6 per cent of postoperative epididymitis in a series of 1624 reported cases without vasectomy or vasoligation collected by the same authors.

Technique. The technique of partial vasectomy employed in our clinic has been evolved by Goldstein. The operation consisted of simple bilateral section of the vas with ligation of the cut ends with catgut. In several cases, a portion of the vas and its sheath on each side was removed. In 1927 the latter procedure was made an essential feature of every operation on the vas performed as a preliminary measure to prostatectomy. Other refinements in technique have been made from time to time, i.e., burying the distal end with a layer of fascia and transfixing the upper end below the skin.

The operation is performed on each side through a lateral scrotal incision 2 to 3 cm. in length, the lower end of the incision situated at or above the level of the superior pole of the testicle. (Fig. 1-A.) If desired the vas may be isolated first through the scrotal skin with the fingers (Fig. 1-B) or with an Allis clamp, and the skin incision made directly over the vas. The incision is carried through the skin and subcutaneous fascia as far as the tunica vaginalis of the spermatic cord. The cord is then grasped between the thumb and index finger and the vas identified by palpation. The vas and its sheath are grasped with an Allis clamp and the remainder of the cord is allowed to drop into its normal position (Fig. 1-C). A long doubled chromic No. 2 catgut suture is passed beneath the vas and its sheath. The suture is cut into two equal lengths and each strand of catgut is pulled in opposite directions with a slight sawing motion in order to separate the vas and its sheath from the underlying tissues (Fig. 11-D). The vas and its sheath are isolated for a distance of 1.5 cm. and at least 1 cm. removed (Fig. 11-E), individually ligating the cut ends with the strands of catgut. One end of each ligature may be

left long for further suturing. The distal (lower) end of the vas is covered with a layer of tunica vaginalis by means of a continuous Lembert suture (Fig. 11-F). The proximal (upper) end is brought down and anchored to the tunica vaginalis so that a layer of tissue is interposed between the cut ends (Fig. 11-G). The skin is closed with continuous or interrupted black silk sutures. No drainage of the operative area is instituted. The wound may be covered with collodion or a dry sterile dressing and an appropriate scrotal support, i.e., suspensory or scrotal bandage made of gauze or adhesive plaster, is applied.

The time consumed by a bilateral partial vasectomy seldom exceeds ten minutes. Although the procedure in every case in this series was done in the operating room, the technique is so simple and the amount of material required so scant that the procedure can be performed easily under local anesthesia in the patient's room, the cystoscopic room or the urologist's office.

The advantages of this method of vasectomy are obvious. (1) *Adequate exposure is obtained to insure identification of the vas thus eliminating the possibility of ligating a sclerotic or thrombic vein.* (2) *The open method enables the surgeon to remove the desired amount of vas and its sheath and to ligate securely each of the cut ends of the vas including the sheath.* (3) *Regeneration of the vas is impossible as the distal end of the vas is buried in such a manner that a layer of tunica vaginalis is interposed between the cut ends.* (4) *The proximal end is anchored to the outer layer of the tunica vaginalis immediately under the skin so that if an abscess should develop in this end of the vas, it can be readily incised and drained.* (5) *Through he proximal end, the surgeon can easily inject the seminal vesicles with an antiseptic solution in order to treat or prevent an infection of the seminal vesicles.*

Analysis of 208 Cases. This study, based on 208 bilateral partial vasectomies performed in the past eight years, 1926 to 1934, on the Urological Service of Sinai Hospital, includes only those cases in which the operation was employed to prevent the development of an epididymitis in patients with prostatic disease. This series does not

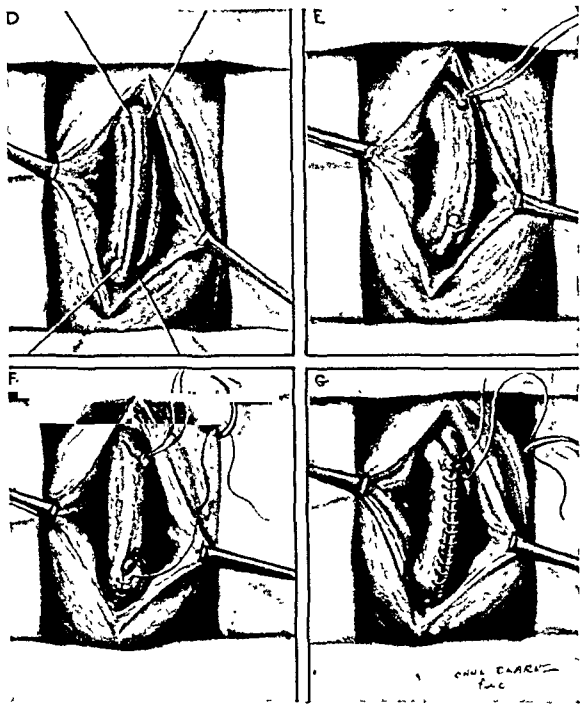


Fig. 2. (D) Vas and sheath isolated from other structures in the cord by a suture placed beneath the vas and its sheath; (E) 1 cm. of vas and its sheath removed and the cut ends securely ligated; (F) the lower distal end is covered over with tunica vaginalis by means of a continuous Lembert suture; and (G) the upper proximal end is anchored to the tunica vaginalis so that a layer of fascia is interposed between the cut ends.

include the 25 cases reported from this hospital by Goldstein at the meeting of the American Urological Association in 1926.

In Table 1 the cases are classified according to the clinical diagnosis confirmed by either cystoscopy, operation or histological study of the operative specimen. In this compilation no attempt was made to differentiate the various anatomical or pathological types of benign enlargement of the prostate.

In this series all but 6 cases had one or more operations performed subsequent to the vasectomy. Of these 6 cases, 2 received repeated cystoscopic fulgurations for a bladder tumor and 4 were not subjected to further operative treatment for the following reasons: extremely poor condi-

tion due to presence of extensive infiltrating carcinoma of prostate; patient refused further treatment other than intermittent catheterization; and 2 patients succumbed

TABLE I
CLINICAL DIAGNOSES

I. Benign hypertrophy of the prostate	
A. No accompanying lesions	154
B. Accompanying lesions	
1. Bladder diverticulum	5
2. Bladder neoplasm	4
3. Bladder calculi	10
4. Prostatic calculi	3
5. Prostatic abscess	1
6. Pre-operative epididymitis	6
7. Hydrocele	9
8. Spermatocele	1
II. Carcinoma of Prostate	14
III. Stenosis of vesical neck following prostatectomy	1
Total	208

after vasectomy during preparation for prostatectomy. The various operations performed on the remaining patients are recorded in Table II.

TABLE II
SUBSEQUENT OPERATIONS IN 202 CASES

I. Prostatectomy	
A. One stage suprapubic	2
B. Two stage suprapubic	49
C. Perineal	87
II. Suprapubic Cystotomy	
A. Simple	6
B. Combined with:	
1. Fulguration of bladder tumor	1
2. Repair of trigon and vesical neck	1
III. Suprapubic lithotomy	1
IV. Diverticulectomy and subsequently	
A. Suprapubic prostatectomy	2
B. Resection of prostate	1
V. Resections of prostate	55
A. Resection and subsequent prostatectomy	9
VI. Prostatotomy	1
Total number of operations	215

The choice of anesthesia for vasectomy varied according to type of patient and the time of operation. Local infiltration with 0.5 per cent novocain was employed in 100 cases. Occasionally, in these cases it was necessary to block the nerves of the spermatic cord. In nervous and apprehensive individuals, other forms of anesthesia, particularly nitrous oxide inhalation (11 cases) or intravenous anesthesia with evipan (20 cases) were employed. When the vasectomy is combined with some other scrotal operation, i.e., hydrocele, spermatocele or epididymectomy, or performed at the time of perineal prostatectomy, or at one of the two stages of a suprapubic prostatectomy, a more profound and lasting anesthesia is required. Thus in 42 cases caudal anesthesia using 30 c.c. of 2 per cent novocain, was employed and in 35 cases spinal anesthesia with 100 mgms. novocain. Ether anesthesia was not used in any case except as an adjuvant to gas anesthesia in the prolonged cases.

TABLE III
TIME OF VASECTOMY

A. Vasectomy before preliminary instrumentation or catheter drainage	78
B. Vasectomy after institution of catheter drainage	75
C. Vasectomy after catheter drainage but combined with other major or minor operative procedures (55 cases) viz:	
1. One stage suprapubic prostatectomy	2
2. First operation in two stage suprapubic prostatectomy	13
3. Second operation in two stage suprapubic prostatectomy	3
4. Perineal prostatectomy	22
5. Hydrocele operation	8
6. Epididymectomy	3
7. Suprapubic fulguration of bladder tumor	2
8. Circumcision	1
9. Injection of seminal vesicles and prostate	1
Total	208

A careful study was made of the time of vasectomy in relation to (a) preliminary diagnostic instrumentation, (b) the institution of catheter drainage, and (c) subsequent operations on the prostate and bladder (Table III). The purpose of this study was to determine: (1) whether or not catheter drainage played an important role in the development of postoperative scrotal complications; and (2) the significance of the time interval between the institution of catheter drainage and the vasectomy in the prevention or development of these complications. Every patient in this series of 208 cases had catheter drainage in preparation for a prostatic operation.

In the 78 cases in group A the vasectomy was done immediately or shortly after admission and before any diagnostic instrumentation or catheterization was per-

mitted. It has been the practice, whenever possible, to insert the first indwelling catheter at the conclusion of the vasectomy. This group developed the least number of postoperative complications; viz. vasitis, 2 cases; abscess of scrotal wound, 1 case; and scrotal edema, 1 case.

In the 75 cases comprising group B for various reasons the vasectomy was performed after catheter drainage had been instituted. In some instances, the patient's condition was too poor due to uremia, cardiac decompensation, pulmonary complications, etc. to warrant the risk of a vasectomy before directing all efforts to improve the patient's general health with the usual restorative measures including catheter drainage. Several patients were admitted with chronic retention of urine and the bladder was decompressed for several days before vasectomy. In a large number of cases who had uninfected bladder urines, vasectomy was intentionally postponed for several days. The intervals of time elapsing between the institution of catheter drainage and vasectomy varied from one to thirty-four days, with an average of 9.4 days. This group showed a greater incidence of postoperative scrotal complications than group A; vasitis occurred in 5 cases, abscess of the scrotal wound in 3 and scrotal edema in 1.

In the 55 cases in group C vasectomy was postponed also until after catheter drainage had been instituted for essentially the same reasons mentioned. However, this group is distinguished from the previous group by the fact that the vasectomy in each case was combined with a major or minor operation on the prostate, bladder, epididymis, seminal vesicles, etc. The number of days of preliminary catheter drainage in this series varied from three to forty-five days, with an average of 16.4 days. It is interesting to note that postoperative scrotal complications occurred more often in this group than in either group A or B. A vasitis developed in 8 patients, 4 of them had a vasectomy combined with perineal prostatectomy, 3 with the first step of two-stage suprapubic prostatectomy and one with circumcision. An abscess of the scrotal wound occurred in one patient who had a vasectomy combined with a hydrocele operation, and scrotal edema developed in one patient who had the vasectomy at the first step of a two-stage suprapubic prostatectomy.

The more frequent occurrence of scrotal complications in group C than in group A suggests the influence of an additional factor besides catheter drainage inasmuch as vasectomy was performed after preliminary catheter drainage in both groups. This other factor in all probability is closely related to the combining of vasectomy with a major or minor operation on the bladder, prostate, scrotum, etc. A very plausible explanation is found in the contamination of the scrotal wound, which may be due either to the direct transportation or implantation by the surgeon's fingers or instruments of organisms from an infected area (scrotal skin, prostate or bladder) into the scrotal wound, or to the subsequent seepage of infected urine from a perineal or suprapubic incision into the scrotal wound or dressings. In those cases where a vasectomy is performed at the same sitting as a suprapubic cystotomy or prostatectomy or perineal prostatectomy, it has been our practice to do the bladder or prostatic operation first and then the vasectomy. This order of procedure is also followed in other clinics, notably by Keyes, who found that when vasectomy was performed before the abdomen was opened in the first or second stage of suprapubic prostatectomy, a postoperative rise in temperature from 101° to 104°F. occurred, attributed to contamination of the abdominal wound with organisms carried from the scrotal skin by the fingers despite the fact that the abdominal wound looked clean. He pointed out that when the abdomen was opened before the scrotum, the rise in temperature did not occur. However, the order of procedure is not important providing the proper precautions in technique are taken to insure perfect asepsis,

viz. the use of separate sets of instruments for each operation, careful preparation of operative area, changing operative drapings and apparel for each operation, and adequate sterilization of hands between operations.

Complications. The postoperative complications of vasectomy in this series of 208 cases are indicated in Table IV.

TABLE IV
POSTOPERATIVE COMPLICATIONS OF 208 VASECTOMIES

Condition	Cases	Percentage
Epididymitis	0	
Scrotal hematoma	2	.96
Scrotal edema	3	1.44
Scrotal abscess	5	2.40
Vasitis	15	7.21
Peritonitis or intestinal obstruction	1	.48
Total	26	12.50

Epididymitis. The development of an epididymitis following vasectomy is a rare occurrence. In the preliminary series of 25 cases reported by Goldstein, one patient, 4 per cent, developed a questionable epididymitis which on reexamination of the reported clinical findings rather appears to be a vasitis. Crabtree and Brodney reported 4 cases of epididymitis following bilateral vasectomy in a series of 141 prostatectomies.

In this series of 208 vasectomies, there were no cases of postoperative epididymitis. The value of this procedure is further emphasized by a comparative study of the incidence of postoperative epididymitis in a series of non-vasectomized patients operated in the same period of time. There were 14 cases, 11.4 per cent, of postoperative epididymitis in a series of 122 patients who had operative treatment for prostatic disease but were not vasectomized.

In addition to epididymitis, there is another group of pathological lesions which may occur after vasectomy or vasoligation. These complications are confined to the scrotum in the majority of cases, viz:

1. *Hematoma.* The formation of a scrotal hematoma usually occurs immediately after the vasectomy and is the result of puncturing one of the spermatic veins during the dissection of the vas. This is more likely to occur on the left side due to the frequent presence of a varicocele on this side. This unpleasant complication can be avoided by securing accurate hemostasis before closing the skin incision, i.e., ligation of every bleeding point in the spermatic cord, tunica vaginalis and subcutaneous tissues of the scrotum. This complication occurred in two of our patients; one was of minor degree being confined to the scrotum on the affected side and responded to local measures, the other was extensive, involving the scrotum, perineum and penis and required opening of the incision and ligation of bleeding points.

2. *Scrotal Edema.* A unilateral swelling of the scrotal tissues may develop on the morning following operation and disappear four to five days later after proper elevation of the scrotal contents and application of ice bags. It is difficult to state whether this enlargement of the scrotum is due to edema from circulatory embarrassment or to lymph stasis resulting from the trauma incidental to operation. This condition was first described in 1929 by Read and Morgan who considered it to be a circulatory phenomenon. There is no infectious process present, which with the absence of other local and constitutional symptoms, serves to differentiate this condition from an early scrotal abscess or cellulitis. A unilateral scrotal edema occurred in 2 cases and bilateral in 1 case. In each instance, the condition was asymptomatic and was determined at the first dressing on the third postoperative day. Each case cleared up in three to four days.

3. *Scrotal Abscess or Cellulitis.* This condition may be due (a) to the failure to maintain perfect asepsis at the time of operation or during the postoperative period when infected urine is permitted to seep through the dressings over the wound; (b) to the development of abscesses about the sutures in the skin; or (c) to the devel-

opment of an abscess in the proximal (upper) end of the cut vas or about the catgut ligatures on the severed ends of the vas. An unilateral and relatively mild abscess of the scrotal wound was observed in 5 cases in the author's series. One case was diagnosed on the second day after vasectomy, 2 on the fifth day, 1 each on the seventh and seventeenth day. All cases responded within two to three days to conservative treatment. Two cases were directly attributable to stitch abscesses. Scrotal cellulitis did not develop in any case.

In the early stages this condition may manifest itself by an increased moisture and slight congestion of the wound or localized abscess formation which responds well to local heat and antiseptic dressings. If the infectious process remains unrecognized, it spreads to the subcutaneous tissues of the scrotum producing an induration of the tissues surrounding the testicle which has been mistaken for an epididymo-orchitis. The application of dry or moist heat and the institution of drainage in the operative area will quickly clear up the condition. In rare instances the infection may spread from the scrotal tissues into the penis, abdomen or perineum within the confines of Colles' fascia producing a localized abscess or a diffuse cellulitis. Occasionally, the infection may even penetrate the tunica vaginalis of the testicle to produce an epididymo-orchitis which may go on to abscess formation with eventually complete necrosis of the epididymis and testicle requiring orchidectomy. The author has observed such a case following vasectomy performed at another hospital.

4. *Vasitis, with or without Localized Abscess Formation.* This condition was first described by Morson and later emphasized by Crabtree and Brodney, Swan and others. In the author's series vasitis occurred in 15 cases, 7.21 per cent, unilateral in 13 (right 5, left 8) and bilateral in 2 cases. The process was localized in every case and was confined to the proximal (upper) end of the cut vas in 14 cases and to the inguinal canal in 1. In 2 unilateral cases and 1 bilateral case, a localized abscess in the proximal end of the vas required incision and drainage. In the remaining cases, the vas showed a localized thickening which cleared after two to three days of local treatment. Of the 8 cases which developed a vasitis after vesectomy, 7 were subjected also to some other major or minor operation. In the 7 cases, vasitis developed three weeks after vasectomy.

Vasitis may occur at any time during the postoperative course, but most frequently two to three weeks after vasectomy. The earliest symptom is a persistent aching pain in the groin accompanied by a slight elevation in temperature. Examination of the tissues in the region of the external abdominal ring reveals a diffuse tender induration of the proximal end of the vas. The affected stump usually becomes enlarged, varying in size from a pea to a walnut, representing a localized inflammatory process in the stump of the vas and the immediately surrounding tissues. If the condition fails to respond to local heat, a localized abscess forms which requires incision and drainage to effect resolution. In none of the cases does the infection appear to cross the point of resection or ligation; consequently, involvement of the epididymis and testicle does not occur. The symptoms rarely persist for more than four to five days unless an abscess develops which requires drainage for several days. Occasionally the onset of symptoms may be so sudden and acute that the condition may be mistaken for a strangulated inguinal hernia, according to Morson. The condition is due to the extension of an infectious process from the prostatic area or seminal vesicles down the vas and if the vas had not been previously ligated or resected in these cases an epididymitis would develop. Rectal examination in these cases usually discloses a thickened inflamed seminal vesicle on the corresponding side. Hot rectal douches or irrigations, rectal diathermy and hot sitz baths help to clear up the seminal vesiculitis.

The development of scrotal complications following vasoligation or vasectomy adds a new morbidity factor. In his series of 25 vasectomies, Goldstein observed 3 cases or 12 per cent, of vasitis. Crabtree and Brodney collected 309 vasectomies and noted 11 cases, or 3.5 per cent, with scrotal complications. Swan and Mintz mentioned 4 cases of abscess of the scrotum following vasectomy and later Swan reported 3 additional cases and stated that 1 to 3 such cases are seen every year following vasectomy at the Massachussetts General Hospital in Boston.

In 1930 Cashman reviewed 327 cases of chronic prostatic obstruction receiving surgical treatment and found 61 patients, 18.5 per cent, developed an epididymitis. Further analysis revealed that 208 cases were not treated by vasoligation or vasectomy and a complicating epididymitis developed in 52 cases, or 25 per cent. The remainder 119 cases had some form of vasoligation, i.e., 13 cases by the closed method and 106 cases by the open method. In those treated by the closed method, there were 4 poor results, 30.7 per cent, viz. infections of the wound, sloughing, hematoma and consequently this method was abandoned. Of those treated by the open method, 5 cases, 4 per cent, developed some infection in the scrotum, 3 of which were unilateral epididymitis.

One case in our series developed paralytic ileus and died after vasectomy and is reported because of the unusual complication and the fatal outcome. A review of the literature fails to reveal a similar report.

Case Report. E. M., a seventy year old man, a tailor, was admitted at Sinai Hospital on September 5, 1932, presenting the usual symptoms of prostatism. Physical examination was negative except for a right indirect (reducible) inguinal hernia about the size of a hen's egg. Rectal examination disclosed a moderately enlarged prostate. Cystoscopy revealed an intravesical enlargement of the median and both posterolateral lobes. The bladder capacity was 300 c.c. and residual urine was 50 c.c. The usual examination of the urine and blood and renal functional tests were negative.

A diagnosis of benign hypertrophy of the prostate was made and the treatment advised was a preliminary bilateral vasectomy and subsequent transurethral resection of the prostate. At 10:00 A.M. on September 7, 1932, a bilateral partial vasectomy was performed under caudal anesthesia, using 40 c.c. one per cent novocain. At the conclusion of this operation, a No. 20 F. soft rubber urethral retention catheter was passed into the bladder and strapped in place. No difficulty was encountered in passing the catheter and no previous catheter drainage had been employed.

At 6:00 P.M. that night the patient vomited about 200 c.c. blood tinged fluid. Examination of the abdomen and throat were negative. The vomiting was attributed to effects of the anesthesia. Patient was given a hypodermic injection of ¼ grain morphine at 8:00 P.M. and fell asleep. On the following day the patient complained of marked abdominal distention and was unable to retain fluids. The temperature was 99°F. and the pulse rate varied between 72 and 84. A rectal tube and two small enemas gave little relief. The operative wounds showed no abnormal changes. The abdominal distention persisted and on September 9, gastric lavage followed by instillation of an ounce of castor oil with turpentine stupes and pituitrin were not effective in overcoming the abdominal distention. Several enemas were given but were only slightly effectual. During the day two intravenous injections of 500 c.c. of 10 per cent concentrated glucose solution were given.

On September 10, the patient's condition became progressively worse. The temperature rose to 101.6°F. and pulse to 90. He continued to vomit all fluids, the vomitus being coffee-colored and bloody. The abdominal distention persisted despite all therapeutic efforts. The scrotal wounds appeared to be healing per primum and showed no evidence of infection. The blood urea was 49.03 mgms. per cent, blood creatinin 1.8 mgms. per cent, and blood chlorides 4.78 mgms. per cent. The leucocyte count was 13,200 with 65 per cent polymorphonuclear cells. A diagnosis of adynamic ileus and pneumonia at right lower base and confirmed by a surgical diagnosis of intestinal obstruction of seventy-two hours duration.

At 1:00 A.M., September 11, the patient's condition was rapidly becoming worse, the temperature was 102°F., pulse 90, and respirations 24. The abdomen was markedly distended throughout and showed a boardlike

rigidity. There was no incarceration of the right hernia. No masses, fluid or dullness were discernible in the flanks. An enema was ineffectual. Operative interference was not deemed advisable, and seven hours later he died. Permission for an autopsy was refused.

Comment. In the absence of an autopsy, the exact nature of the intestinal obstruction was not clearly established. The possibility of a mesenteric thrombosis was considered but in the absence of a marked leucocytosis with a high polymorphonuclear count, bloody stools and cardiac pathology, this diagnosis did not seem probable. A mechanical obstruction due to an internal herniation or unrecognized carcinoma could not be entirely ruled out. Peritonitis was also considered as a probable etiological factor but the time and mode of onset of the ileus in this case rendered such a diagnosis improbable. It has also been suggested that during the vasectomy operation the scrotal sac of the right indirect inguinal hernia was injured or penetrated in some unrecognized manner and served as a focal point for the peritonitis. However, this explanation does not appear to be tenable in view of the fact that the hernia was not disturbed during the process of isolating and resecting the vas and the vasectomy was accomplished with ease. The occurrence of signs and symptoms of gastrointestinal disease of the reflex type of following operations on the lower genitourinary tract is well recognized. However, it is highly improbable that a reflex situation resulting from the scrotal operation caused such a severe and persistent paralytic ileus.

CONCLUSIONS

The following conclusions are based upon the results obtained in the series of 208 vasectomies reported herein and a review of the experiences of other authors on the same subject:

1. The incidence of preoperative and postoperative epididymitis in prostatic patients treated by prostatectomy or transurethral resection can be reduced considerably by employing vasectomy or vasoligation.

2. Vasectomy is a more satisfactory procedure than vasoligation in the prevention of epididymitis in prostatic surgery. The reduction in the incidence of complicating epididymitis with vasectomy is greater than with vasoligation. In the author's series of 208 vasectomies, epididymitis did not develop in a single case.

3. In a very small percentage of cases, epididymitis may occur after vasectomy or vasoligation as a result of (a) the lighting up of a preexisting or latent infection in the epididymis or vas, (b) hematogenous infection secondary to an intercurrent disease or focal infection (c) faulty operative technique. The first two types can not be prevented whereas the latter can be avoided.

4. Errors in operative technique can be obviated by employing the open method of vasectomy. In this manner, the vas can be accurately isolated, at least 1 cm. of the vas removed, and the cut ends of the vas securely ligated. To prevent regeneration of the vas, it is advisable to bury the distal end in the tunica vaginalis so that a layer of tissue is interposed between the cut ends of the vas.

5. Vasectomy should be performed as early as possible, preferably before urethral instrumentation or preliminary drainage with an indwelling urethral catheter.

6. Although the efficacy of vasectomy in the prevention of epididymitis remains unquestioned, a new morbidity factor has been introduced in a small number of cases by the development of a scrotal complication other than epididymitis; (a) vasitis with or without abscess formation at the proximal stump of the vas, (b) abscess of the scrotal wound with subsequent scrotal cellulitis, (c) edema of the scrotum, and (d) hematoma.

7. An unusual complication of vasectomy is an adynamic ileus which occurred in one case in the author's series.

[*For References see p. 44.*]

EXPERIMENTAL STUDIES OF BACTERIAL CHOLECYSTITIS*

HANS G. ARONSOHN, M.D.

From the Department of Surgery, University of Chicago

CHICAGO

BOTH Andrews[1] and Magner,[2] studying the contents of human gall bladders removed at operation, have found 65 per cent to contain sterile bile. Osler[3] places this figure at 52 per cent. An important role in the production of cholecystitis seems to be played by factors other than infection, mainly those of a chemical nature. Recent investigations conducted by us[4] have shown that bile acids, which long have been known to be of high toxicity for tissues outside of the gall bladder, develop a definite toxicity for the gall-bladder wall itself if present in a sufficiently high concentration. Further studies are now in progress on the exact role played by the bile acids. Although the importance of infection in this connection is possibly not primary, its existence as a factor cannot be completely disregarded for several reasons. First, one is tempted to draw an analogy as regards the gall bladder from the fact that infection plays an important part in the pathology of most other organs. Secondly, one must take into account the fact that many reliable workers, after extensive studies, have concluded that infection is the main factor in the production of cholecystitis. Very little is known about the actual route which the infection follows. The five possibilities, as given in Graham's textbook,[5] are as follows: (1) descending infection from the liver; (2) ascending from the duodenum via the common duct; (3) hematogenous; (4) lymphatic; (5) directly through the gall-bladder wall from an inflamed adjacent organ. To determine the route by which the infection spreads is not the essential point of this study. Our purpose is to ascertain by animal experimentation whether or not an increase either in number or virulence of the bacteria in bile leads to cholecystitis, and whether different bacteria show different behaviors in this regard. A considerable number of bacteria may be present in normal bile, but since these gall bladders do not manifest any changes either clinically or anatomically, we are not justified in calling such bile "infected." Bile may be considered as "infected" if it contains either an abnormally high number of bacteria or bacteria of especially great virulence. The organisms might be those which occur normally or might accrue in the bile from any pathological sources in the body. Any bacteriological study of the biliary system presupposes knowledge of the normal bacteriological flora of the liver and gall bladder as well as the kind and origin of pathological organisms and the route by which these might reach the gall bladder. Since our experimental studies are based on certain fundamental factors which are considered to be proved, a brief review of the literature is in place.

The occurrence of cholecystitis in cases of typhoid fever led early investigators to consider the infectious nature of gall-bladder disease. As early as 1763, John Hunter[6] associated inflammation of the gall bladder with typhoid fever, an idea which was proved bacteriologically by Gilbert and Girode[7] in 1890 and confirmed clinically by Chiari.[8] There followed a series of experimental studies which attempted to produce "carriers" or even reactions of the gall bladder, by injection of typhoid bacilli. Blackstein[9] found the bile to contain bacteria for many days or weeks following the intravenous injection of Bacillus coli and Bacillus typhosus in rabbits. Other

* Work done in part under a grant from the Douglas Smith Foundation.

bacteria were subsequently used by further observers, Sherrington[10] injecting Bacillus anthracis, Bacillus pyocyaneus, and staphylococci and obtaining 18 "infected" biles from 49 cases. Whether or not the gall-bladder wall showed any pathology in these experiments could not be ascertained from the data given in the literature, since the chief interest of the author was directed towards the production of "carriers." Gilbert,[11] in 1894, considered Bacillus coli to be the most important organism in the production of cholecystitis and favored the idea of an ascending infection from the duodenum. This view was opposed by Cushing and Livingood,[12] who found the duodenum to be very low in bacterial content and even sterile when empty. Further contributions were made while attempting to produce stones experimentally. Cushing,[13] after direct inoculation of typhoid bacilli into the gall bladders of rabbits, observed inflammation of the gall bladders with the formation of concrements. Similar experiments were performed on dogs and rabbits by Italia,[14] who used attenuated cultures of Bacillus coli and Bacillus typhosus. This author mentions an inflamed gall-bladder mucosa, incidental to the formation of concrements. Rolleston[15] emphasizes the need for an additional factor other than the presence of bacteria, such as trauma, stones, or stasis, for the production of cholecystitis. This author points out that though the frequency of typhoid fever is decreasing (Bacillus typhosus is found in the bile in almost all severe cases of typhoid fever), there is an increase in the frequency of cholecystitis. Similarly, Osler[16] states that cholecystitis in typhoid fever occurred in only 19 of his series of 1500 cases. Later workers again considered the blood stream to be the route by which bacteria reach the gall bladder and produce cholecystitis. There was great disagreement, however, as to whether the organisms reach the gall bladder directly through the arterial blood stream or indirectly by way of the portal vein, liver, and duct system. Rosenow,[17] who demonstrated the specific affinity of streptococci and partly also of Bacillus coli to the gall bladder, considers the direct arterial route to be the

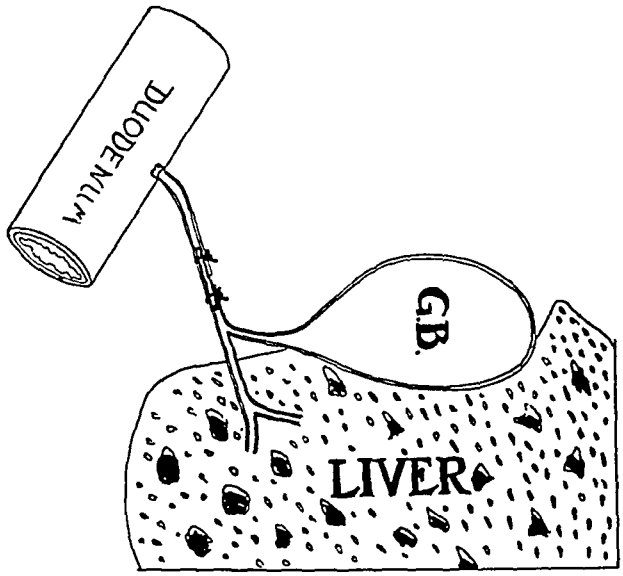


Diagram: Showing cannula and gall bladder after the common duct had been opened and the catheter introduced into the gall bladder.

usual mode of infection, since he obtained positive reactions by intravenous bacterial injection and negative results by direct inoculation into the gall bladder. Schöbl,[18] on the other hand, who tried to produce "cholera carriers" experimentally, obtained the opposite results, direct inoculation into the gall bladder being more effective than intravenous injection. There is no mention in this work whether or not a change occurred in the gall-bladder wall. Doerr[19] observed that excretion of typhoid bacilli into the bile, which occurred regularly after injection of the former into the systemic veins, could be prevented by ligation of the cystic duct. On the basis of this experimental work he concluded that bacteria indirectly reach the gall bladder by excretion through the liver. Koch[20] and Chiarolanza,[21] however, arrived at the opposite conclusion. Typhoid bacilli were found in the gall bladder after intravenous injection even after a preceding ligation of the cystic duct. This observation, together with the fact that microscopic study of a large number of inflamed gall bladders revealed "emboli" in the

folds of the mucous membrane, led these authors to conclude that "a transverse infection of the wall" is the usual route. Nichols[22] concurred with the hematohepatogenous route of Doerr on the basis of his work on rabbits. This author found that injection of typhoid bacilli into the mesenteric veins yielded "gall-bladder lesions" in 63 per cent of the cases, while injection into the ear vein resulted in only 41 per cent of positive cases. Emmerich and Wagner,[23] after direct injection of typhoid bacilli into the gall bladders of rabbits, obtained a chronic infiltration and thickening of the gall-bladder wall. However, the fact that these animals had been immunized with typhoid serum previous to the injections might have slackened and diminished the inflammatory reaction. In contrast to these observations, Venema,[24] in similar experiments, obtained a normal gall bladder. In 1921 Meyer[25] and his co-workers confirmed the validity of the hematohepatogenous route, which they believed to be the only one proved definitely in the literature, by observing positive reactions in the gall bladders of rabbits both by intravenous injection of typhoid bacilli and direct inoculation of the same organism into the gall bladder. Rosenow's theory of a hematogenous infection was further enhanced by Brown,[26] who found mainly streptococci in the emulsified gall bladder tissue from human cases of cholecystitis. This author demonstrated serologically the direct etiological importance of these streptococci and demonstrated their specific affinity for the gall bladder by intravenous injection in rabbits. The very complete survey by Magner and Hutcheson revealed that the most common organism in the cavity of the gall bladder is Bacillus coli, while in the wall it is streptococcus. These workers injected staphylococci into both the wall and cavity of rabbits' gall bladders and in every instance of subserous injection obtained positive reactions in the gall-bladder walls, but in only a limited number of cases following injection into the lumen. Hunlemüller,[27] examining gall bladders obtained at human operations, revealed positive bacterial cultures in 100 per cent of cases when he included in his statistics both the gall-bladder wall and the liver. During the last ten to fifteen years the belief in the infectious origin of cholecystitis has become considerably weakened. Wherever the infectious theory is still maintained, the route is considered to be especially by way of the lymphatics from the liver, as suggested by Graham. In 1922, Drennan,[28] who emphasized the antibacterial activity of the bile, found only 19 of 100 biles removed at operation, to be infected. The scarcity of clinical signs of infection, the lower fever and slight leucocytosis, as well as the rare occurrence of leucocytes in bile even in cases of so-called "empyema," based upon a study of a large amount of surgical and necropsy material, convinced Denton[29] that infection does not play a primary role in the production of cholecystitis but that certain other factors, such as mechanical or chemical ones, are the basic causes. Feinblatt,[30] in a study of 400 clinical cases, obtained results similar to Drennan and Denton, observing very few inflammatory changes in the gall-bladder wall and very few leucocytes in the bile or fluid content.

From this brief review of the literature, one can see the present confused state of the question of the relationship between the bacterial content of the gall bladder and the pathology of that organ. The information yielded by different authors varies considerably and often is contradictory. While bacterial studies of the gall bladder obtained at human operations and postmortem examinations are reliable and valuable, experimental studies of the same problem are much less satisfactory, due to the differences in the techniques employed by various investigators, some of which may be actually misleading. The commonest method, introduction of the bacteria by means of a needle puncture through the gall-bladder wall, often results in a localized injury to the wall at the point of puncture, thus making the results uncon-

trollable. This disadvantage was recognized by many early workers, Rosenow stating that "localized cholecystitis occurred at the point of puncture when the injection was made directly into the gall-bladder." Similarly Venema mentions the fact that the infection produced by the usual technique, which consisted of needle puncture with subsequent tying off of that part of the wall, is especially marked and is accompanied by a severe injury to the gall bladder wall. According to Wilkie,[31] the changes at the neck of the gall bladder, where the injection had been made, contrasted sharply with the fundus of the organ, which still appeared normal. The work of Phemister[32] and Graham,[33] however, indicates that it is possible to obtain normal gall bladders even with this usual technique, if the proper degree of care is administered. In experiments with dogs, Phemister injected Streptococcus viridans intramurally and performed in addition a cystic duct ligation, yet the gall bladders remained normal in all but one case, where a subsequent mixed infection accounted for the marked inflammatory changes. Similarly, Graham and Peterman obtained negative results following the injection of Bacilli coli into the wall of the gall bladder in dogs. In this instance, however, additional ligation of the blood vessels or cystic duct resulted in definite changes.

Some improvement of the needle puncture technique was made by Venema, who cauterized the wall at the point of the injection. It is perhaps to this improved technique that we can attribute the fact that this author obtained normal gall bladders after direct inoculation of typhoid bacilli, while similar experiments by Emmerich and Wagner yielded positive reactions. Hospers[34] varied the procedure by making the injection through the liver surface of the gall bladder, a method which leaves the free surface of the gall bladder practically unharmed, as we have seen, but may cause occasional bleeding in the liver tissue and thus influence the adjacent gall bladder. The method of intravenous injection practiced by Rosenow and many others is much more satisfactory. A positive reaction of the gall bladder following an intravenous injection of bacteria may be attributed with certainty to a specific affinity of these organisms to the biliary system. Negative results are valueless in this connection. Although the organisms may not reach the gall bladder via the blood stream, they may still possess a definite affinity for the biliary system if brought there by any other way. Another disadvantage of intravenous injection is the production of a bacteremia, which ordinarily is not present in cases of human cholecystitis, and might facilitate the production of cholecystitis by causing an abnormal reaction of the organism as an entity.

It is now evident that there is great doubt as to which route bacteria actually follow, under either normal or pathological conditions, which are found eventually in the gall bladder. Consequently we will limit ourselves to the effects of the actual presence of organisms in the gall bladder either of especially great virulence or in abnormally high numbers. This condition can be created experimentally by means of our "nontraumatizing" technique.[35] We employed this procedure in most of our experiments, using the method of injection by a fine needle puncture in only a few instances, which served to compare the two techniques.

Method. Only dogs were used in our experimental work, the operations being performed under ether anaesthesia and strictly aseptic conditions. The abdomen was opened by a midline incision and the common duct incised close to the duodenum. A soft French rubber catheter was introduced into the gall bladder and 10 to 15 c.c. of bile were aspirated by means of a syringe. Injection of the bacterial suspension was accomplished at this point by means of another syringe, and this was followed by re-injection of the aspirated bile into the gall bladder, thus washing the common and cystic ducts as free as possible

from bacteria. It might incidentally be mentioned at this point that this washing was sufficiently effective to prevent any marked infection of the mucous membrane of the ducts. The catheter was then withdrawn and a glass cannula inserted into the opening which had been made in the common duct. By means of this technique, the gall bladder in most instances was not visualized during the entire procedure, practically assuring freedom from traumatization. In those instances in which we failed to introduce the catheter into the gall bladder, we injected the bacterial suspension by means of a direct needle puncture and in addition performed a ligation of the cystic or common duct. For this injection, we preferred always to use the liver surface of the gall bladder rather than the free surface, thus minimizing the amount of trauma to the gall-bladder wall. In several cases a needle puncture was used for the injection without any duct ligation, to determine whether or not stasis of the bile favors infection of the gall-bladder wall. The simple catheter-cannula technique is the only method that has yielded normal controls. It has always been a handicap in gall bladder studies that if injection was made through the gall-bladder wall a considerable degree of cholecystitis might arise and furthermore if the duct was ligated or drained externally, the control experiments very frequently were not normal. Therefore we have never been able previously to either remove or introduce material into the gall bladder without causing some degree of damage, which vitiates the experiment.

The diagram shows the cannula in place after the common duct had been opened and the catheter introduced into the gall bladder.

The bacteria used for injection were obtained from human sources, as acute adenitis, sinusitis, acute and chronic mastoiditis, etc. The cultures were of recent isolation. The organisms were suspended in saline solution, in a concentration of approximately 500 million bacteria per c.c., the criterion used being the cloudiness of the suspension as compared with one of known bacterial content. One c.c. of this suspension was generally the amount injected. Wherever a marked reaction occurred, the experiment was repeated with 0.5 c.c. or less, while 2 c.c. were used in those cases in which there was no reaction. The dogs were electrocuted twenty-four hours after the operation and postmortem examination performed as soon as possible. A microscopic examination of the gall-bladder wall was made in every case except those which died spontaneously and where postmortem changes had occurred. Those animals which died from any other cause, as leakage from the gall bladder or ducts, pneumonia, etc. were not included in this study.

Protocols. In all, 36 dogs were operated. In Charts I, II and III are shown the detailed results of the experiments. A gall bladder was considered to be normal if it revealed no changes either on gross or microscopic examination. "Cholecystitis 1" indicates that the gall-bladder wall was of normal thickness, but there was some edema and congestion in the serosa. A fibrinous membrane was either completely absent or seen only in places. "Cholecystitis 2" included those cases in which the gall-bladder wall was thickened up to 4 mm. and the inflammatory signs were more definite, the fibrinous exudate covering the serosa as a thick membrane. "Cholecystitis 3" indicates that the wall is thicker than 4 mm., the gall bladder usually lies imbedded deeply in the liver, and the adjacent organs, the duodenum, omentum, etc. form a large inflammatory tumor around it. The terms "about normal" or "slight reaction" were used in those cases in which the changes were non-inflammatory in character, i.e., distention of the gall bladder, congestion of the serosa without any edema or fibrinous exudate, mechanical injury to the wall, etc. Whenever the introduction of the catheter or insertion of the cannula was attended with difficulty, the term "traumatization" was included in the column

labelled "complications." Wherever this happened the value of the experimental results are limited, as they are in those instances in which the animals died spontaneously and postmortem changes occurred in the gall bladder. Similarly, experiments in which the common or cystic duct was tied are of value only when the gall bladder remained normal in spite of the bacterial injection and duct ligation.

Chart 1

Streptococcus hemolyticus

Strain from: (1) Acute mastoiditis 1—3 dogs
(2) Acute sinusitis—6 dogs
(3) Acute mastoiditis 11—2 dogs
(4) Chronic mastoiditis—1 dog

Exp't. No.	Strain Injected	Amount	Method of Introduction	Duct	Complications	Results
1	Acute mastoiditis 1	0.5 cc.	Catheter	Cannula	Dying when electrocuted	Cholecystitis 3, bile peritonitis
2	Acute mastoiditis 1	3 drops	Catheter	Cannula	Died	Cholecystitis 3, postmortem changes
3	Acute mastoiditis 1	3 drops	Catheter	Cannula	Very sick	Cholecystitis 2–3
4	Acute sinusitis	2 cc.	Catheter	Cannula		Gall bladder normal
5	Acute sinusitis	1 cc.	Catheter	Cannula		Gall bladder about normal
6	Acute sinusitis	2 cc.	Catheter	Cannula		Gall bladder normal
7	Acute sinusitis	1 cc.	Catheter	Cannula		Cholecystitis 1
8	Acute sinusitis	1 cc.	Needle puncture	Common duct ligation		Thickening of gall-bladder wall
9	Acute sinusitis	1 cc.	Catheter	Cannula		Gall bladder about normal
10	Acute mastoiditis 11	1 cc.	Catheter	Cannula		Gall bladder normal
11	Acute mastoiditis 11	1 cc.	Catheter	Cannula		Gall bladder normal
12	Chronic mastoiditis	1 cc.	Catheter	Cannula		Gall bladder normal

Results. Since streptococci and Bacillus coli are the organisms most commonly accused of being the causative agents in the production of gall-bladder infection, we placed special emphasis in our experimental work on the actual effect which these bacteria have. Very striking results were obtained with Streptococcus hemolyticus, the details of which appear on Chart 1. Four different strains of the organism were used for the injections. Although three of the four strains used were from acute human infectious processes, only one produced changes in the gall bladder. The changes were very marked and occurred in the 3 cases in which this particular strain was injected. One of these animals died within fifteen hours after the injection, the second was moribund in twenty-four hours, and the third was in poor condition when killed. Only three drops had been injected into the animal which died. These results are in direct contrast to the experiments on nine dogs in which the other three strains of Streptococcus hemolyticus were injected. None of these animals died spontaneously nor did any of them exhibit any marked signs of illness during the twenty-four hours between the injection and electrocution. In 5 of these 9 cases, postmortem examination revealed perfectly normal gall bladders, while in 3 other cases the changes were very slight and not inflammatory at all. In only one instance, that of dog No. 7, did a slight but definite cholecystitis develop following injection of the Streptococcus hemolyticus from an acute sinusitis, and the technique was not accountable for this change.

The injection of Bacillus coli yielded definitely negative results, which are summarized on Chart 11. In 3 cases in which the catheter method had been employed the gall bladder remained perfectly normal.

In 4 animals in this group (4, 6, 7 and 8), the slight changes manifested could definitely be attributed either to traumatization at the time of operation or to the ligation of the cystic or common duct. In none of these were the changes so marked that they could be attributed to the bacterial injection. Only one gall bladder (dog No. 5) revealed an intense reaction, apparently due to the ligation of the common duct.

From Chart III it can be seen that the results likewise are negative. None of the organisms caused any inflammatory changes on the gall-bladder wall and any slight change which occurred could easily be attributed to traumatization or duct ligation.

The charts show that when the same type of bacteria is injected through the catheter the gall bladder remains normal, but if injected by needle puncture, or if the cystic or common duct ligation is added, then they cause cholecystitis or death.

Microscopic examination of the gall bladder in the experiments where streptococcus hemolyticus isolated from acute mastoiditis cases had been injected, reveals that the enormous thickening of the wall is caused chiefly by a swelling of the serosal layer to about five times its normal thickness. The latter is edematous and hyperemic, contains a leucocytic infiltration, and is covered with a purulent fibrinous exudate. Although there is a scattered leucocytic invasion of the muscular layer, this as well as the mucosal surface is mostly unchanged. Those gall bladders, however, into which had been injected another strain of Streptococcus hemolyticus as well as Staphylococcus, Bacillus Welchii and Bacillus coli, proved to be practically normal both grossly and microscopically.

In summarizing these experimental results, we may conclude that there is little tendency for an acute bacterial infection of the gall-bladder wall to result from the contents of that organ. Only Streptococcus hemolyticus gave a positive reaction, and this only in the case of one of the four strains used. Since traumatization or extension from an adjacent pathological process can be definitely ruled out as a cause for this change, we may deduce that the organism or its toxins present in the bile reached the serosal layer of the wall by traversing the mucosal and muscular layers without causing any changes in these. None of the other organisms injected, although present in the bile in overwhelming numbers, caused any change in the gall-bladder wall.

The experimental results we obtained partly confirm and partly contradict those reported in the literature. We found bacterial infection of the gall-bladder wall

CHART II
BACILLUS COLI

Exp't. No.	Bacteria Injected	Amount	Method of Introduction	Duct	Complications	Results
1	B. Coli	1 c.c.	Catheter	Cannula		Gall bladder normal
2	B. Coli	1 c.c.	Catheter	Cannula		Gall bladder normal
3	B. Coli	2 c.c.	Catheter	Cannula		Gall bladder normal
4	B. Coli	1 c.c.	Catheter	Cannula	Some traumatization	Cholecystitis 1
5	B. Coli	1 c.c.	Needle puncture	Common duct ligation	Some traumatization died	Cholecystitis 3, post-mortem change, bile peritonitis
6	B. Coli	1 c.c.	Needle puncture	Common duct ligation	Very sick	Dilated gall bladder with fibrinous exudate
7	B. Coli	1 c.c.	Needle puncture	Common duct ligation		Gall bladder about normal
8	B. Coli	1.5 c.c.	Needle puncture	Cystic duct ligation		Slight reaction on gall bladder

to occur less frequently than recorded by other authors. All observers have described the streptococcus as playing an important part in producing inflammation of the gall-bladder wall. The diverse results we obtained with different strains of this organism concur with the observations of Rosenow and Magner and Hutcheson, who stressed the varying activity within this group on the basis of differences in virulence. Magner and Hutcheson divided the streptococci into two chief groups, which they classified as typical and atypical:

Typical streptococci were characterized by the formation of smooth, non-hemolytic, colorless or green colonies on blood agar, and by the fact that they were killed by exposure to the action of bile. Atypical streptococci were characterized by the formation of rough, non-hemolytic, white colonies on blood agar, and by the fact that they were not killed by the action of bile. Chronic cholecystitis was produced in 100 per cent of cases by injecting typical streptococci under the serous coat of a rabbit's gall bladder.

The negative results we obtained using Bacilli coli stand in direct disagreement both with the clinical data reported by Gilbert and the experimental work done with this organism by Italia. However, the fact that Staphylococcus aureus and albus, Streptococcus viridans and Bacillus Welchii, all failed to produce cholecystitis, agrees in the greater part with the results reported in the literature.

CHART III

(1) Staphylococcus albus—3 dogs
(2) Staphylococcus aureus—6 dogs
(3) Streptococcus viridans—3 dogs
(4) Bacilli Welchii—4 dogs

Exp't. No.	Bacteria Injected	Amount	Method of Introduction	Duct	Complications	Results
1	Staph. albus	1 cc.	Catheter	Cannula		Gall bladder normal
2	Staph. albus	1 cc.	Needle puncture			Gall bladder normal
3	Staph. albus	1 cc.	Needle puncture	Cystic duct ligation	Traumatization	Slight reaction on gall bladder
4	Staph. aureus	1 cc.	Catheter	Cannula		Gall bladder normal
5	Staph. aureus	1 cc.	Catheter	Cannula		Gall bladder about normal
6	Staph. aureus	2 cc.	Catheter	Cannula		Gall bladder normal
7	Staph. aureus	2 cc.	Catheter	Cannula	Traumatization	Bile peritonitis, some reaction on gall bladder
8	Staph. aureus	2 cc.	Needle puncture			Slight reaction on gall bladder
9	Staph. aureus	1 cc.	Catheter	Common duct ligation	Died	Cholecystitis 3, postmortem changes
10	Strep. viridans	1 cc.	Catheter	Cannula		Gall bladder about normal
11	Strep. viridans	1 cc.	Catheter	Cannula		Gall bladder normal, some bile peritonitis
12	Strep. viridans	2 cc.	Catheter	Cannula		Gall bladder normal
13	B. Welchii	1 cc.	Catheter	Cannula		Gall bladder normal
14	B. Welchii	0.5 cc.	Catheter	Cannula		Gall bladder normal
15	B. Welchii	1 cc.	Catheter	Common duct ligation	Traumatization died	Postmortem change on gall bladder
16	B. Welchii	0.5 cc.	Needle puncture	Common duct ligation		Gall bladder about normal

SUMMARY

1. Animal experimentation conducted on 36 dogs indicates that an increase either in the number or the virulence of bacteria

in gall-bladder bile using a non-traumatizing technique, seldomly produces a reaction in the gall-bladder wall. A severe infection of the wall was obtained in 3 dogs, which had been injected with one particular strain of Streptococcus hemolyticus. The gall-bladder wall remained practically unchanged, however, upon the injection of three other strains of Streptococcus hemolyticus, as well as Bacillus coli, Streptococcus viridans, Staphylococcus aureus and albus, and Bacillus Welchii.

2. In many cases the same organisms injected directly through the gall-bladder wall, or with an accompanying ligation of the common or cystic duct, produce severe or even fatal cholecystitis.

CONCLUSION

The results seem to confirm the earlier statement of Graham that cholecystitis of biliary origin is difficult to produce without the additional factor of trauma or stasis.

REFERENCES

1. Andrews, E. and Henry, L. D. The bacteriology of normal and diseased gall bladders. Waiting publication in the *Arch. Int. Med.*
2. Magner, W. and Hutcheson, G. M. Cholecystitis. *Can. Med. Assn. Jour.* 27: 469, 1932.
3. Osler. Modern Medicine. Philadelphia, Lea and Febiger, 1907.
4. Aronsohn, H. G. and Andrews, E. Bile salt cholecystitis: Preliminary report. *Proc. Soc. Exp. Biol. and Med.* In press.
5. Graham. Diseases of the Gall Bladder and Bile Ducts. Philadelphia, Lea and Febiger, 1928, 114.
6. Hunter, John. cited in Rolleston, Diseases of Liver, Gallbladder and Bile Ducts.
7. Gilbert and Girode. *Compt.-rend. Soc. de biol.*, Paris, p. 756, 1890; ibid. p. 956, 1893.
8. Chiari. *Prag. med. Wchnschr.*, No. 22, 1893. *Ztschr. f. Heilk.*, Bd. xv, p. 199.
9. Blackstein. *Bull. Johns Hopkins Hosp.*, pp. 96 and 121, 1891.
10. Sherrington, T. Pathology and Bacteriology, i, p. 259, 1892–93.
11. Gilbert et Dominici. *Compt.-rend. Soc. de biol.*, p. 38, (Jan. 20) 1893.
12. Cushing and Livingood. *Johns Hopkins Hosp. Rep.* 9: 543, 1900.
13. Cushing, H. *Bull. Johns Hopkins Hosp.*, 10: 166, 1899.
14. Italia, F. E. *Policlinico*, 1901; cited *Zentralbl. f. Chir.* 28: 693, 1901.
15. Rolleston. Diseases of the Liver and Bile Ducts. 1905 and 1929.
16. Osler, William. Practice of Medicine, 1905, p. 83.
17. Rosenow, E. C. *J. A. M. A.* 63: 1835, 1914; and *Jour. of Inf. Dis.* 19: 527, 1916.
18. Schöbl, Otto. Experimental cholera carriers. *Jour. of Inf. Dis.* 18: 307, 1916.
19. Doerr: *Zentralbl. f. Bakt.* 39: 624, 1905.
20. Koch, T. *Ztschr. f. Hyg.*, 1: 1, 1908.
21. Chiarolanza, R. *Ztschr. f. Hyg.*, 1: 11, 1908.
22. Nichols, H. T. *Jour. Exp. Med.* 24: 497, 1916.
23. Emmerich and Wagner: *Zentralbl. f. allg. Path. u. path. Anat.* 27: 433, 1916.
24. Venema, T. A. *Berl. klin. Wochen.* 815, 1917.
25. Meyer, K. F., Nelson, N. M. and Fensier, M. L. *Jour. Inf. Dis.* 28: 457, 1921.
26. Brown, R. O. *Arch. Int. Med.* 23: 185, 1919.
27. Hunlemüller. *Klin. Wochen.* iii: 349, 1924.
28. Drennan, T. G. *Ann. Surg.* 76: 482, 1922.
29. Denton, T. *Arch. of Surg.* 14: i, 1927.
30. Feinblatt, H. M. New England Med. 199: 1073, 1928.
31. Wilkie, A. L. *Brit. Jour. of Surg.* 15, 1927–28.
32. Phemister, D. B. Calcium carbonate gallstones and their experimental production. *Ann. Surg.* p. 595, (Oct.) 1932.
33. Graham, E. A. and Peterman, M. G. *Arch. Surg.* 4: 23, 1922.
34. Hospers, C. A. *Arch. of Path.* 14, 66–78, (July) 1932.
35. Aronsohn, H. G. and Andrews, E. A non-traumatizing technique for study of chemical cholecystitis. *Proc. Soc. Exp. Biol. and Med.* 32, 1629–1631, 1935.

ROTARY DISLOCATION OF ATLAS ON AXIS*

J. O. RANKIN, M.D., F.A.C.S.

Department of Surgery, Wheeling Clinic

WHEELING, W. VA.

A SMALL number of cases of traumatic rotary dislocation of the atlas on the axis are reported in the literature. Brooks reports a group of cases in conjunction with other cervical injuries; Langworthy reports 13, Coutts 8 and Jackson 4 cases, but most authors report one or two cases. In this paper I desire to add 9 cases.

Judging from the small number of cases, one might assume that the accident is quite uncommon. I believe that it occurs more frequently than generally indicated and that the correct diagnosis is rarely made. For this reason I feel that it is desirable to report a few of these cases so as to bring this condition to the attention of the profession in general.

ANATOMY

The atlanto-axial articulation is complicated in construction. There are four definite and distinct joints. (1) The two gliding joints between the lateral masses on each side. Both articular facets of the atlas and axis are convex, although the inferior facets of the atlas are more acute than those of the axis. The surfaces of both are directed forward, downward, and outward. (2) The atlanto-odontoid joint which is between the posterior surface of the anterior arch of the atlas and the odontoid process. This is a rotary or pivot joint. (3) The transverse odontoid joint between the posterior surface of the odontoid process and the transverse ligament. This is a sliding joint.

The atlas and axis are bound together by the anterior and posterior atlanto-axial ligaments. The transverse ligament is attached to a prominent tubercle on the inner side of each lateral mass and passes just posterior to the odontoid process. The continuity of the spinal canal and the normal relationship of the two vertebra are directly dependent upon ligamentous structures. Rupture or relaxation will permit dislocation and encroachment upon the neural canal.

ROENTGENOGRAPHIC FINDINGS

Difficulties are frequently encountered in obtaining satisfactory roentgenographic studies of this area. Frequently a definite diagnosis cannot be made from the *x*-ray films. In numerous instances the patient cannot cooperate for *x*-ray examination on account of his deformity.

To obtain a thorough roentgenographic study both anteroposterior and lateral pictures must be made. The axis of the *x*-rays for the anteroposterior view should pass through the center of the open mouth. For the lateral view it should be centered on the atlas.

In the anteroposterior view Coutts has emphasized the importance of the lateral deviation of the spine of the axis. This deviation is toward the same side as that to which the rotated chin points. For example, if the chin is pointed to the right, the spine of the axis will be to the right of the midline, with each successive cervical spine being nearer to the midline. This is in contradistinction to the position of the spines in normal rotation of the head. Here they will be found on the opposite side. This deviation is due to the attempt of the cervical spine to bring the dislocated atlas to the "eyes front" position.

Dislocation of one facet of the atlas will result in an overlapping or narrowing of

* Read at the Sectional Meeting of the American College of Surgeons at Washington, D. C., April 12, 1935.

the joint space on the affected side and probably some widening at the other side.

The two sides of the posterior arch are not directly superimposed on each other in a direct lateral view. The posterior arch will



Fig. 1.



Fig. 2.

Fig. 1. Case VIII. Before reduction: Rotary dislocation anteriorly of the right lateral mass of the atlas on the axis Spinous process of the axis points to the left of the midline in the same direction as the chin.

Fig. 2. Figure 1 after reduction. Spinous process of the axis and the chin both point toward the midline.

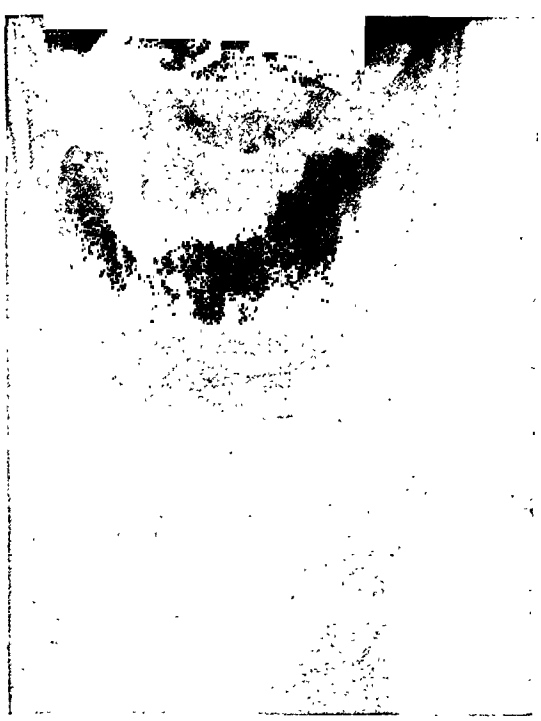


Fig. 3. Case VI. Rotary dislocation anteriorly of the right lateral mass of the atlas with almost complete obliteration of the intervertebral space between the atlas and axis on the right side.

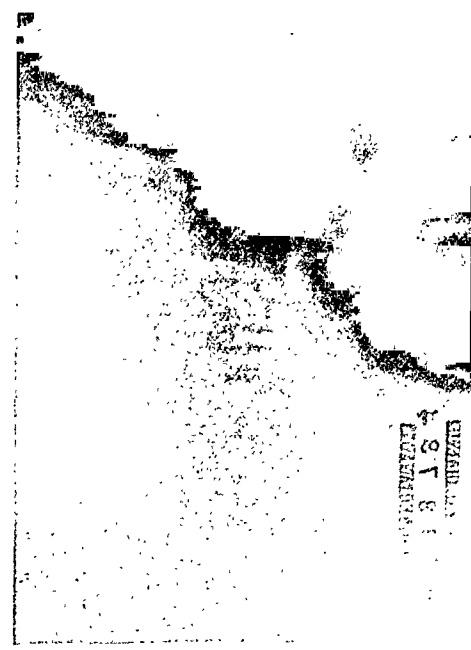


Fig. 4. Anterior displacement of the atlas will show divergence of lines drawn through the base of the atlas and the base of the spinous process of the axis. Normally they are parallel or converge.

The appearance of lateral displacement of the atlas on the axis may be the result of projection on a partially rotated atlas and must be thoroughly studied.

appear broader than normal in a unilateral dislocation.

Any degree of anterior displacement of the atlas will be revealed by a divergence of the lines of the body of the atlas and spine of the axis. Normally they converge or are parallel.

MECHANISM OF DISLOCATION

The primary function of the atlanto-axial joint is to permit rotation of the head. Anatomically this is a gliding joint in which normal movements are controlled by numerous and relatively lax ligaments, reenforced by the muscles used to rotate the head.

The degree of difference between the full normal range of motion and simple rotary dislocation is very slight. According to Corner, sudden, unexpected, mild force applied to the limit of the former motion results in the rupture of a part of the capsular ligament with the dislocation of one of the atlantoid facets.

ETIOLOGY

Berkheiser and Seidler, Coutts, et al., have described a number of cases of distention luxation which are the result of effusion into the atlanto-axial joints, secondary to upper respiratory disease. A few of these cases occurred following paralysis of the cervical muscles due to anterior poliomyelitis. The cases I am discussing are all the result of trauma. In many instances the trauma was so mild that dislocation would seem impossible.

SYMPTOMS

The typical case gives a history of some type of accident causing a sudden forcible twisting of the head, but a sudden voluntary twist of the head often accomplishes the same result (*see* Case VII). The accident is followed immediately by a severe pain in one or both sides of the neck and inability to move the head, particularly in rotation. Any attempt at motion aggravates the pain. In some cases there is difficulty in opening the mouth. Usually the patient is treated for everything from torticollis to quinsy, without relief.

SIGNS

The classical position of the head and neck is pathognomonic. Once the deformity has been seen, the diagnosis will rarely be missed in a subsequent case.

The chin points away from the side that is dislocated. The head is tilted toward the dislocated side. There is no rotation toward



FIG. 5. Typical deformity of the head in an anterior rotary dislocation of the right lateral mass of the atlas on the axis.

the affected side and very slight rotation away from it. Slight flexion and extension may be present. The head is supported by the hands when the patient arises from the recumbent position.

Palpation of the neck reveals the spinous process of the axis on the opposite side of the midline from the side which is dislocated, that is, toward the side to which the chin is rotated. This deviation is increased as the head is straightened. The patient of Case IV was treated for several weeks for an enlarged gland in this region. In reality it was a spastic group of muscles over the posteriorly displaced lateral mass of the atlas which was mistaken for a glandular swelling.

DIAGNOSIS

The diagnosis is based upon the following findings:

(1) History of forcible twisting of head;

(2) Typical attitude of head and neck in fixed rotation and tilt;

(3) Spine of the axis is displaced from the midline to the same side as that to which the chin points;

(4) Straightening the head increases the deviation of axial spine from the midline.

Rotation of the head away from the dislocated atlas facet permits the axial spine to reach the midline.

(5) Roentgen ray reveals:

(a) A narrowing of the atlanto-axial intervertebral space on the dislocated side and widening of the other;

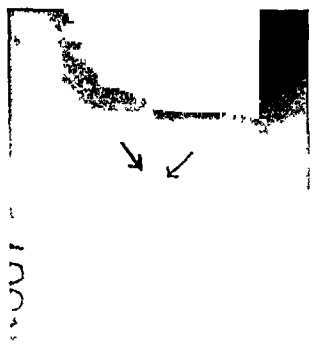


Fig. 6. Case IV. Bilateral rotary dislocation of the atlas on the axis. The right lateral mass was anterior. The spinous process of the axis points to the left of the midline.

(b) The posterior arch of the atlas appears broadened;

(c) There may be a divergence of the lines of the base of the atlas and the lower border of the spine of the axis;

(d) The inverted V-shaped spinous process of the axis will be seen on the same side of the midline as that to which the chin points.

TREATMENT

Reduction is obtained by (1) constant traction with the jury-mast, (2) forcible manipulation under anesthesia, or (3) open reduction. Eight of our cases were reduced by the use of the jury-mast.

Case IV had unsuccessful traction by a jury-mast for three weeks. Manipulation by the Walton method was then tried without success. This failing, an attempt was made at open reduction. During the manipulation a carelessly placed hemostat tore a hole in the vertebral artery. A large amount of blood was lost before the bleeding was controlled and the operation had to be stopped with hemostats left in the wound. These were later removed and the wound closed. The jury-mast was reapplied, and fifty-six days from admission the reduction was complete.

Traction is accomplished by placing the patient on a Bradford frame, the head of which is 12 to 18 inches higher than the



Fig. 7. Figure 5 in a retention cast after reduction.

foot, in order that the weight of the body may be used for countertraction. The patient is strapped to the frame to prevent motion. This is particularly necessary in children. A small pillow or rolled sheet is placed under the neck, or the frame may be curved to obtain hyperextension. Fifteen to twenty pounds of weight are used in adults. The traction must be constant except while the patient is eating. Sedatives are usually indicated the first few days.

When reduction has been accomplished the deformity disappears and the patient is able to turn his head from side to side without pain. Roentgen ray examination will reveal normal relationship of the atlas and axis.

A plaster cast of the head and chest is then applied by one of two methods. If the patient is able to sit up, he is placed on a stool with the body erect and the head held in hyperextension by a jury-mast made of a muslin bandage. This is easily removed after the cast has dried. Some patients are very nervous and will faint if they are in a sitting position, necessitating the application of the cast in the supine position. To

do this we use the regular Albee fracture table. The patient is put in the reverse position with the head at the foot of the table; the shoulders and upper part of the body rest on the spinal support which extends to the first dorsal vertebra. The head is held by an assistant in the hyperextended position with the muslin jury-mast or halter. After the cast dries the spinal support is pulled out of the cast.

Felt should be placed under the cast over the shoulders to relieve pressure. Chamois skin is placed under the chin to prevent irritation. Windows for the ears should be cut in the cast, and sufficient space should be allowed in the axilla to permit free movement of the arms. At the end of two or three weeks the head portion of the cast may be removed for the comfort of the patient.

In our cases the casts remained in place five to eight weeks. During this period all patients were ambulatory. Following the removal of the casts physiotherapy was instituted for a period of two or three weeks.

Some authors prefer forcible reduction by manipulation under anesthesia. From a review of the literature the Walton method seems to be the procedure of choice. Langworthy reduced all 13 patients in his series by this method. Brooks applied the Walton method by itself or in conjunction with the Taylor procedure in his series.

Walton's method is done by the hands of the operator. In a unilateral anterior dislocation to the left the right hand is placed under the jaw and neck on the right side and the left on the forehead and face on the left side. The head is then rotated to the right to increase the deformity and disengage the facets. At this point the head is tilted to the right to raise the facet of the atlas over the facet of the axis. The head is then rotated to the left and brought back in hyperextension as the facet rides back into normal position. This procedure should be performed under anesthesia.

Any manipulative procedure entails a certain element of danger. Jackson reports a case that immediately developed a convulsion followed by deep syncope for several minutes.

	SEX	AGE	PERIOD OF DISLOCATION	HISTORY	ANTECEDENT DISEASE
1	F	19	2 weeks	Followed fall from fainting	None
2	M	10	3 days	Occurred during wrestling match	None
3	F	56	5 months	Result of somersault in gymnasium class	Hypertrophic osteoarthritis of cervical spine
4	F	9	3½ months	Knocked down by schoolmates	Upper respiratory disease
5	M	3	2 weeks	Fell off porch roof	None
6	M	13	1 day	Boxing with brother	None
7	F	23	1 day	Sudden voluntary twist of head	None
8	M	12	1 day	Struck on head playing basketball	None
9	M	51	7 weeks	Automobile accident	None

Fig. 8. Table for comparison of cases

Open reduction has been done in a few cases but is rarely necessary.

PROGNOSIS

Simple uncomplicated rotary dislocation of the atlas can be reduced by traction or manipulation in practically every case.

	TYPE OF DISLOCATION	X-RAY FINDINGS	METHOD OF REDUCTION
1	Unilateral right anterior	Unsatisfactory	Extension with jury-mast
2	Unilateral left anterior	Unsatisfactory	Extension with jury-mast
3	Unilateral left anterior	Positive	Extension with jury-mast
4	Bilateral—right anterior and left posterior	Positive	Jury-mast, Walton manipulation, open reduction
5	Unilateral left anterior	Unsatisfactory	Extension with jury-mast
6	Unilateral right anterior	Positive	Extension with jury-mast
7	Unilateral right anterior	Positive	Extension with jury-mast
8	Unilateral right anterior	Positive	Extension with jury-mast
9	Unilateral right anterior, fracture, right lateral mass.	Positive	Extension with jury-mast

Fig. 9. Table for comparison of cases.

Once reduced, if it is retained in position for several weeks by casts or some other retention apparatus, the probability of

recurrence is remote. One exception to this rule is found in Case VI; the patient suffered the same anterior rotary dislocation of the atlas on two different occasions within a period of eight months. However, a careful study of the history discloses the fact that each dislocation was the direct result of a blow delivered in such a manner as to cause this type of dislocation.

	TIME REQUIRED FOR REDUCTION	PERIOD IN CAST	END RESULTS
1	14 days	6 weeks	Complete recovery
2	6 days	6 weeks	Complete recovery
3	10 days	4 weeks	Complete recovery as far as dislocation is concerned
4	51 days	8 weeks	Slight limitation of motion to right
5	6 days	6 weeks	Complete recovery
6	5 days	6 weeks	Complete recovery
7	3 days	6 weeks	Complete recovery
8	7 days	6 weeks	Complete recovery
9	6 days	8 weeks	Complete recovery

Fig. 10. Table for comparison of cases.

CASE REPORTS

Case I. Mrs. L. G., a white female, aged nineteen years, came to the Wheeling Clinic on July 13, 1928, complaining of a stiff and painful neck and inability to rotate the head.

The history revealed that two weeks previously while working in the kitchen she suddenly fell to the floor in a faint. On regaining consciousness she experienced a severe pain in her neck and was unable to turn her head or open her mouth but a short distance. For two weeks she was treated by several different doctors for tonsillitis and enlarged cervical lymph glands without any improvement.

Physical examination revealed the typical rotary dislocation of the atlas to the right. She could not rotate the head to the right. The mouth could only be opened a short distance and there was a tender lump over the region of the atlas and axis on the left side posteriorly. The spine of the axis was palpable to the left of the midline.

Roentgen ray examination was not satisfactory due to inability of the patient to cooperate because of the painful deformity.

The patient was placed on a Bradford frame which was hyperextended in the cervical region. A jury-mast was applied with fifteen pounds traction, which was increased to twenty pounds in a few days. Reduction was effected in about two weeks. On August 1st a plaster cast was applied to the neck and chest with the patient in the sitting position and the head held in hyperextension with a jury-mast. This proved so uncomfortable that it had to be removed on August 8th and was replaced with a complete head and chest cast. She was discharged from the hospital on August 9th.

For ten days of the period that she was in the cast she attended the horse races daily. (We should have collected our fee before the ponies did!)

The cast was worn until September 8th, when it was removed. One week later she returned for observation. There were no pain and no limitation of motion. She was discharged as cured.

The final diagnosis was traumatic anterior rotary dislocation of the right lateral mass of the atlas to the right.

Case II. R. M., white male, aged ten years, was admitted to the Ohio Valley General Hospital on September 12, 1928. He gave a history of wrestling with his brother three days previously, during the scuffle developing severe pain in his neck and noticed that he could not move his head.

Examination revealed that the chin pointed to the right with tilting of the head to the left side. All attempts at motion were painful. There was no rotation to the left and very little to the right. The spinous process of the axis was to the right of the midline.

X-ray examination revealed a narrowing on the left side of the atlanto-axial articulation. The odontoid process was normal. A diagnosis of left rotary dislocation of the atlas on the axis was made.

Laboratory examinations were negative except for a few red blood cells in the urine, which cleared in a few days.

The patient was put on a Bradford frame with a canvas retaining sheet over him. A jury-mast was applied with twelve pounds of weight, and a small pillow was placed under the neck. Six days later he was able to rotate his head normally. The extension was continued two days more. A plaster cast was applied on September 20, 1928, from the waist to the top

of the head. This was done with the patient sitting on a stool and the head held in extension with a jury-mast. The patient was discharged from the hospital two days later with permission to be ambulatory. The cast was removed six weeks later. All symptoms had disappeared. Range of motion was normal and no pain was present. The patient was discharged as cured.

Case III. Mrs. R. C., a white female, aged fifty-six years, came to the Clinic on September 29, 1928, with complaints of severe pain in the back of the neck, swelling of the right side of the neck and inability to move the head, existing for six months. It developed immediately after turning a somersault in the gymnasium. Numerous chiropractic adjustments had been given during this period without any relief.

The past history was negative except for extraction of some abscessed teeth in 1925 and some difficulty with the left eustachian tube in 1926.

Physical examination revealed a rather nervous female with the typical deformity of the head and neck of a rotary dislocation of the atlas. The chin pointed to the right with tilting of the head to the left. The spastic cervical muscles formed the swelling on the right side of the neck. The spine of the axis pointed to the right of the midline. All attempts at motion were quite painful. In fact, the patient supported her head with her hands when she attempted to turn the head.

Roentgen ray examination revealed considerable osteoarthritis of all the cervical vertebra. There was some narrowing of the intervertebral disc on the left side with apparently some displacement of the atlas to the right.

A diagnosis of anterior rotary dislocation of the left lateral mass of the atlas on the axis with hypertrophic osteoarthritis of the bodies of the cervical vertebra was made.

The patient was placed on a Bradford frame with a small pillow under the neck. A jury-mast was applied with fifteen pounds of traction which was increased to twenty pounds. Reduction was completed in ten days, and a head and body cast was applied. She was discharged from the hospital in twenty days. The period in the hospital was rather stormy as she had a great deal of pain, was nauseated, vomited frequently, was quite nervous, and did not sleep well.

Three weeks later the cast was removed and daily baking and massage were instituted by a physiotherapist. She returned in ten days for observation. There was no limitation of motion, and there was a marked improvement in the intensity of the pain.

The patient was observed for several years. There was never any recurrence of the deformity, but she continued to have some pain, which was unquestionably due to the arthritis.

Case IV. D. B., white female, aged nine years, was referred to the Wheeling Clinic on April 29, 1930, for heart disease and inability to turn the head. Attention was also called to a painful lump just to the left of the spinal column at the base of the skull.

The history revealed that three years before she had a simple head cold followed by an endocarditis. She was kept in bed for six months. In February, 1930, the thyroid became enlarged, and she lost weight, developed a pulse rate between 140 and 160, and ran a mild febrile course. This condition cleared under treatment by the family physician, although she had not fully regained her normal health. Six weeks before her visit to the Wheeling Clinic she was knocked down in the schoolyard. The deformity of the head and neck immediately followed this accident.

Examination revealed the typical deformity. The chin pointed to the left. There was no rotation to the right. There was some limitation of motion in opening the mouth. The left sternocleidomastoid muscle was tense. Forward and backward motion of the head was present but somewhat limited. There was a tumor mass about one inch in diameter just to the left of the midline posteriorly below the occiput. This swelling had been treated as an enlarged gland. The tonsils were grossly infected. There was a loud systolic murmur heard best at the apex of the heart.

Roentgen ray examination revealed rotation of the atlas on the axis with narrowing of both intervertebral spaces.

This was unquestionably a case of rotary dislocation of the atlas in a patient whose general health had been undermined by an upper respiratory infection followed by an endocarditis and a thyroiditis. Probably the ligamentous structures of the atlanto-axial articulation had been weakened as a result of her infection, and the actual dislocation followed the injury in the school-yard. Due to the

lack of finances the child was not admitted to the hospital until May 29, 1930. She was immediately placed on a Bradford frame with a retention canvas sheet over her. Head traction of fifteen pounds was applied. Reduction did not take place. Manipulation by the Walton method was tried but was unsuccessful.

On July 7, 1930, an open reduction was attempted. The vertebra were exposed and the dislocation was plainly demonstrated. The right side was completely dislocated anteriorly and the left posteriorly. During the manipulation a hemostat on a branch of the vertebral artery made a rent in its wall, a large amount of blood being lost before bleeding could be controlled. The wound was packed with the hemostats in place and a blood transfusion was given immediately. The clamps were removed on the fifth day and the wound closed. Extension with a jury-mast was reapplied. Reduction seemed to be complete a week later. A head and chest cast was then applied with the patient supine on the Albee table, with the spinal support being used as previously described and the head being held in extension with a muslin jury-mast. This was worn for two months. On removal of the cast the patient felt fine, has gained in weight, and had practically normal range of motion. What limitation she had was in rotation to the right.

The difficulty in reduction in this case was probably due to the fact that there was dislocation of both lateral masses of the atlas for a period of four months. I believe the explanation for the reduction which was accomplished in seven days after the closure of the wound is to be found in the fact that many of the ligaments and muscles in this region were severed at operation. The tumor which was supposed to be an enlarged gland to the left of the midline was the left lateral mass of the atlas.

Case v. E. D., a white male, aged three years, was referred to the Wheeling Clinic on May 28, 1934, with the complaints of pain in the neck, inability to turn the head, and limitation in opening the mouth.

The mother gave the history that two weeks before admission he had fallen from a porch roof, alighting on his head. The child had eaten very little, cried most of the time and there had been no improvement in his condition since the accident. There was no history of any antecedent disease.

On examination the child presented the typical symptoms of a rotary dislocation of the atlas. The chin was turned to the right with a tilt of the head to the left. Any attempt at rotation caused severe pain. There was complete limitation of rotation to the left. It was interesting to note that the child tried to hold his head with his hands when he sat erect. Due to the extreme irritability of the child and the tenderness of the neck it was impossible to palpate the spine of the axis.

Roentgen ray examination was unsatisfactory except that we were able definitely to eliminate any fracture.

A diagnosis of an anterior rotary dislocation of the left lateral mass of the atlas on the axis was made, and the patient was sent to the hospital. He was put on a Bradford frame with a retention jacket and extension applied with a jury-mast and eight pounds of traction. In a few days his disposition improved, he cried very little and ate much better. On June 3rd the dislocation seemed to be reduced, but the traction was left on until June 5th, when a head and chest cast was applied. This was done with the child supine on the Albee fracture table, being supported by the spinal bar. The head was held in hyperextension by a muslin halter. He was permitted to walk the next day and was discharged on June 7th. The child walked and played as usual. On July 6th he returned to have his cast removed. There was no pain or deformity, and he had a perfectly normal range of motion. He was seen several months later at which time he was still normal and had had no untoward symptoms.

Case vi. R. T., a white male, aged thirteen years, was brought to the Wheeling Clinic on June 18, 1934, with the complaint of pain at the base of the skull on the left side and inability to rotate the head.

The patient gave a history of having had a boxing bout with his younger brother the preceding day. During the affair the younger brother landed a punch on the left side of the neck with the immediate appearance of the deformity that was observed on admission.

Physical examination revealed the usual deformity. The chin pointed to the left and the head was tilted to the right. There was no rotation to the right and very little to the left. The spine of the axis was palpated to the left of the midline.

Roentgen ray examination revealed a normal intervertebral space between the atlas and axis on the left but almost complete obliteration on the right. The odontoid process was normal.

The clinical diagnosis was, of course, corroborated in this case. It was an anterior rotary dislocation of the right lateral mass of the atlas on the axis.

The patient was hospitalized for extension with a jury-mast on a Bradford frame. A small pillow was placed under the neck for hyperextension. He was soon comfortable on the frame. The dislocation was reduced in about five days, but extension was left on until June 25, 1934. The usual head and chest cast was then applied. The patient sat on a stool with the body held erect and the head in hyperextension with a jury-mast.

He was discharged from the hospital on June 26, 1934. During the six weeks period in which he wore the cast the patient enjoyed all his former activities. After the cast was removed the neck was massaged for a short time. Motion was normal, there was no deformity or pain, and within a few days he was discharged as cured.

This patient had a partial recurrence on the same side eight months after the original injury. He sustained a minor injury to the neck in a skiing accident and while still complaining of a stiff neck he was struck in the neck. The difficulty previously described reappeared immediately. On careful examination it was evident that the condition was not quite so severe the second time. The head was tilted and rotated in the same manner as previously. Only slight movement of the head was possible, and the most marked limitation was in rotation to the right. Reduction was very easily and successfully accomplished in twenty-four hours by extension with the jury-mast. This recurrence was definitely due to a second trauma and probably bore no direct relation to the original injury.

Case vii. Miss D. S., a white female, aged twenty-three years, was first seen October 27, 1934, complaining of severe pain in her neck, inability to rotate the head, and difficulty in opening her mouth.

She gave the history that in the morning she had gone to work with a slightly painful stiff neck. During the morning while standing with her left side to a cabinet, she suddenly looked at a higher cabinet to the left when she experienced a sudden click in her neck, accompanied by a severe pain. Immediately she noticed that her head was locked with the chin pointing to the left. She consulted a chiropractor, but apparently his manipulations were as painful as they were fruitless.

When seen she was almost hysterical and all motions of the head were assisted by her hands. The typical position of the head was present with rotation of the chin to the left. Rotation of the head to the right was impossible, and she could open her mouth only a short distance.

A diagnosis of rotary dislocation of the atlas was made, and the patient was sent to the hospital. The *x*-ray revealed a narrowing of both intervertebral spaces of the atlanto-axial joints. The odontoid process was not fractured. The spine of the axis was seen pointing to the left of the midline. The dislocation was an anterior rotary dislocation of the right lateral mass of the atlas.

The patient was placed on a Bradford frame with a jury-mast on the head with fifteen pounds of traction. The dislocation was reduced in three days. On November 1st the head and chest cast was applied with the patient sitting on a stool with a jury-mast on the head. Extension was made with a block and tackle attached to the ceiling. She was walking around comfortably at the time of discharge from the hospital on November 4th.

The patient was readmitted to the hospital on December 12th for removal of the cast. She remained for four days to have physiotherapy. On discharge she was free of pain and had normal range of motion.

Case viii. H. L., a white male, aged twelve years, was sent to the hospital on November 23, 1934, by the family physician. The chief complaints were pain in the neck and inability to move the head. He gave a history of having been struck on the head and neck while playing basketball on the day of admission.

Examination revealed the chin pointing to the left with a tilt of the head to the right. There was no rotation to the right and very little to the left. He was able to open his mouth only a short distance, and there was tenderness on both sides of the neck posteriorly in the region of the axis.

Roentgen ray examination revealed some displacement of the atlas to the right with slight narrowing of the atlanto-axial articulation on

the right side. The spine of the axis was seen to the left of the midline.

A diagnosis of anterior rotary dislocation of the right lateral mass of the atlas on the axis was made. The patient was placed on a Bradford frame with a retention sheet over him. Extension was applied with a jury-mast and twelve pounds of weight. Reduction was obtained in a week, but the extension was permitted to remain for ten days. A plaster cast was then applied to the head and chest while the patient was sitting on a stool with the head extended by a jury-mast. He was discharged as ambulatory on December 2, 1934. Six weeks later he returned for removal of the cast. There was no pain, and all motions were normal. He was discharged as cured.

Case ix. E. M., a white male, aged fifty-one years, came to the Wheeling Clinic on December 3, 1934, with the complaints of pain in the base of his skull and neck and inability to move his head. He gave the history that seven weeks previously he had been in an automobile accident in which the car turned over several times but at that time he did not realize that he was hurt. However, a few hours later he could not turn his head and a severe pain developed in his neck. He had some treatment without relief. The limitation of motion of the head had been continuous since the onset a few hours after the accident.

Examination revealed the chin pointing to the left with tilting of the head to the right. There was complete limitation of motion in every direction. Tenderness was most marked on the right side of the neck at the base of the skull.

Roentgen ray examination revealed a fracture of the right lateral mass of the atlas, narrowing of the intervertebral space on this side, with anterior displacement of the right lateral mass.

A diagnosis of anterior rotary dislocation of the right lateral mass of the atlas on the axis with fracture of the right lateral mass was made. The patient was placed on a Bradford frame with a jury-mast on the head with twenty pounds of weight for traction. He was quite uncomfortable the first two days, but each succeeding day he felt better. Reduction was completed and a head and chest cast was applied on December 10th. The patient sat on a stool with extension by a jury-mast while the cast was applied. He was quite comfortable in the cast and was soon able to walk normally. He was discharged from the hospital on December 17th.

Two weeks later he returned to the Wheeling Clinic feeling fine and stated that he was driving a car every day. The top of the head portion of the cast was removed.

On February 8, 1935, the patient returned and the remainder of the cast was removed. *X*-ray films revealed the atlas to be in good position and a fair amount of callus was seen in the fracture. Several letters from the patient have been received since that time. He reports that he is doing his regular work, has no pain, and has normal range of motion.

CONCLUSIONS

1. Simple rotary dislocation of the atlas on the axis is not as infrequent as might be supposed.

2. The causative factor is usually a very mild form of trauma.

3. This condition presents a typical deformity which is readily corrected by simple traction or manipulation but to insure good results should be retained in position by a head and chest cast for a period of six to eight weeks.

4. Verification of the diagnosis by *x*-ray is impossible in some cases, due to the difficulty of getting good pictures in the presence of the painful deformity.

REFERENCES

1. Coutts, M. B. Atlanto-epistropheal subluxations. *Arch. Surg.*, xxix: 297–311 (Aug.), 1934.
2. Corner, E. M. Rotary dislocations of the atlas. *Annals of Surgery*, xlv: 9–26, 1907.
3. Berkheiser, E. J. and Seidler, Ferdinand. Non-traumatic dislocation of the Atlanto-axial joint. *J. A. M. A.*, xcvl: 517–523, 1931.
4. Brookes, Theodore P. Dislocations of the cervical spine, their complications and treatment. *Surg., Gynec. and Obst.*, lvll: 772–782, 1933.
5. Jackson, R. H. Simple uncomplicated rotary dislocation of the atlas. *Surg., Gynec. and Obst.*, xlv: 156–164, 1927.
6. Langworthy, Mitchell. Dislocations of the Cervical Vertebra. *J. A. M. A.*, xciv: 86–89, 1930.
7. Walton, G. L. Dislocation of cervical vertebra. *Boston Med. & Surg. Jour.*, cxx: 277–281, 1889.
8. Taylor, A. S. Fraction dislocation of the cervical spine. *Am. Surg.*, xc: 321–340, 1929.

[SCIATIC NEURALGIA]

CONTROLLED BY INTRASPINAL (SUBARACHNOID) INJECTIONS OF ETHYL ALCOHOL

C. W. GOFF, M.D.

Associate Orthopedist, St. Francis Hosp.; Assistant Orthopedist, Newington Home for Crippled Children

HARTFORD, CONN.

INTRACTIBLE pain has been adequately relieved by the subarachnoid injection of 95 per cent and also absolute alcohol. Malignant growths of the pelvis and abdomen, involving sensory nerves with pain, have been the first condition to invoke the use of alcohol in this manner. It is generally conceded that we may resort to any method for relieving pain caused by a condition which will result eventually in death irrespective of any treatment. In these instances alcohol has been used even in the absence of sound experimental evidence to the effect that no permanent damage was done to the nerve structures or to the dura mater of the spinal canal at the site of injection.

Sicard, Reding, Van Erps and Dogliotti all reported cases; Abraham, Greenhill and Schmitz, together with Yeomans, Saltzstein and Stern have been instrumental in a fuller development of the idea. Then came the more conclusive work from the University of California by Aird and Naffziger, in which they show experimental evidence of the neuropathological changes incident to root involvement, motor, sensory and sphincter alterations and the more important findings of the comparatively small margin of safety for effective doses of ethyl alcohol when used in this manner.

The conclusions of all workers appeared to warrant the trial use of absolute alcohol introduced into the subarachnoid space for the relief of sciatic neuralgia. Selected cases were used in which pain of a definite funicular origin was established beyond a doubt. This included funiculitis due to root pressure produced by hypertrophic arthritic changes about foramina, involving lumbar and sacral roots; postural changes accompanied by anomalies of vertebra with similar pain, unrelieved by other methods; chronic back strains in which the sciatic neuralgia proved intractible. A few peripheral sensory nerve involvements because of malignant growths within the pelvis and the abdomen were included, all with relief. These, however, are not included in this report. An ordinary spinal needle was introduced into the subarachnoid space at the level of the root most involved, generally the fifth interspace in the lumbar region. Procaine injected into the skin beforehand is not necessary. Spinal fluid is obtained indicating the needle is just within the subarachnoid space. The patient is then placed on the side opposite the extremity suffering pain, with a sandbag under the loin and hip to raise this point higher than any other part of the spinal canal. The head is flat on the side without pillow; from 9 to 16 minums of alcohol are allowed to enter the canal, drop by drop, consuming at least three minutes in the process. This permits the alcohol to rise at once because of its lighter specific gravity, 0.806, where spinal fluid has a specific gravity of 1.007, and form a puddle around the desired root directly above the point of the spinal needle. The sensory nerves are in the posterior spinal roots, the majority of which are not myelinated or but slightly so, in contradistinction to motor roots. The patient is slightly pronated forward to place the posterior roots a bit higher than the motor roots. The two roots, motor and sensory, are so close together as they approach the foramina, even before the sensory fibres reach their ganglion, that the puddle of alcohol must, of necessity, bathe the motor fibres to a certain extent.

The reason there is not a motor depression with paralysis is accounted for by the fact, in my opinion, that motor nerves are



Fig. 1. Position of patient at time of intraspinal injection. Note that needle, in 5th interspace, is at highest level of cord, trunk flexed laterally over sand bag.

myelinated and well protected, offering great resistance to the cautery action of alcohol. No attempt is made to mix the fluids by withdrawing part into syringe. This action is of course not desired. The needle is withdrawn and the patient kept in this position for thirty minutes watched by an attendant, before he is allowed flat on his face for two hours. He is permitted to leave the hospital four hours later.

Identical effects have been observed by all users. The pain is instantly relieved and a sense of warmth with some numbness following, is the rule. This includes the whole extremity. Patient can always move extremity though it may continue to feel "asleep" for several days. Occasionally the pain returns for a few days but always disappears within two weeks of the injection. The recurrence of the pain is never more than a part of the original neuralgia. Patients are generally immediately relieved. To account for this phenomenon, Lugaro's concept of the relief of neuralgia aptly applies. All the sensory neurons cannot be blocked because the alcohol probably reaches only a portion of them. He believes, that blocking only a number of sensory tracts is sufficient; of course that number must be greater in proportion to the pain. The fact that the patient feels a sense of warmth followed by numbness and occasionally a sense of feeling akin to pouring warm water over leg, points toward the theory of pain conductivity

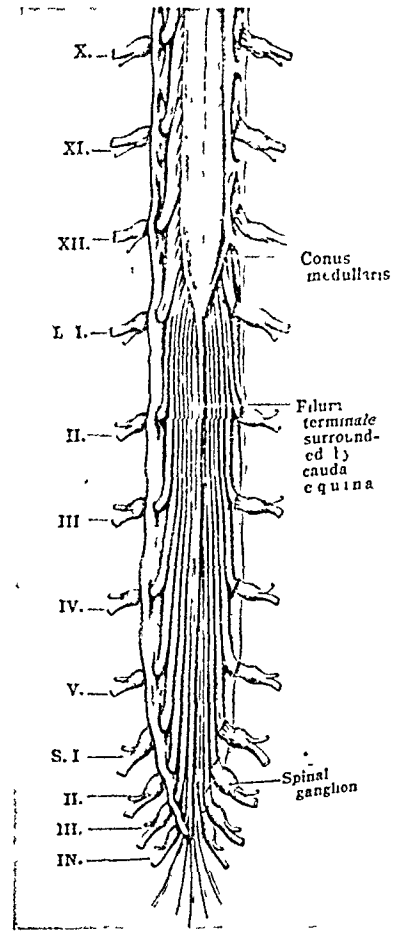


Fig. 2. A clearer idea of position of nerve roots of the cauda equina than used in former articles. Dura mater has been split open in illustration.

along fibres of heat, cold, pressure and touch and not via a separate system of neurons.

CONCLUSIONS

The uniformity of results reported seems to indicate a possibility of this procedure replacing, to a greater extent all major procedures, such as chordotomy, rhizotomy and sympathectomy. Its abuse will bring discredit, which is possible because of the simplicity and range of application. Further use along controlled lines is indicated. The comparatively small safety factor, shown by recent workers, calls for strict

SCIATIC NEURALGIA
Controlled by Intraspinal (subarachnoid) Injection of Ethyl Alcohol

Case Number	Analysis of Results												Complications			
	Am. Absolute Alcohol	Amt. 95 Per Cent Alcohol	Relieved at Once	Relieved Same Day	Recurred Same Day	Recurred in 1 Week	Recurred in 2 Weeks	Entirely Relieved in 3 Weeks	Entirely Relieved in 4 Weeks	Recurring Attacks	Bilateral Injections	Second Injection	Urinary Retension—24 Hours to 3 Days	Rectal Retension—1 to 5 Days	Motor Changes	Unusual Sensory Changes
1		.9 c.c.		x	x			x					x			
2		.9 c.c.	x					x					x			
3		.8 c.c.	x					x								
4		.6 c.c.		x		x		x			x					
5	.8 c.c.		x					x								
6	.9 c.c.		x					x					x			
7	1.0 c.c.		x					x					x			
8	1.0 c.c.		x					x					x			
9	.9 c.c.		x					x								
10	.4 c.c.			x			x	x		x		x				
11	.9 c.c.		x					x								
12	.6 c.c.			x				x								
13	.9 c.c.		x					x		x						
14	1.0 c.c.		x				x		x				x			
15	1.0 c.c.			x			x		x							
16	.9 c.c.		x					x								
17	.8 c.c.		x					x								
18	.9 c.c.		x					x								
*19	.8 c.c.		x			x		x		x			x	x		x
20	1.1 c.c.		x					x					x			

* Ober operation after second attack with complete relief.

adherence to proved technique. At last we have some hope that a simple, useful procedure is at hand for the temporary relief of sciatic neuralgia. Corrective exercises and muscle building can then be applied, in many cases, to overcome most of the causes of this type of pain and a permanent cure obtained.

REFERENCES

Dogliotti, A. M. Nouvelle methode therapeutique pour les algies peripheriques: Injection de alcool dans l'espace arachnoidien. *Rer. neurol.*, 2: 485, 1931.

Yeomans, F. C. Care of advanced carcinoma of the gastro-intestinal tract. *J. A. M. A.*, 101: 1141, 1933.

Saltzstein, H. C. Intraspinal (subarachnoid) injection of absolute alcohol for the control of pain in far advanced malignant growths. *J. A. M. A.*, 103: 242, 1934.

Greenhill, J. P. and Schmitz, H. E. Intraspinal (subarachnoid) injection of alcohol for pain associated with malignant conditions of the female genitalia. *J. A. M. A.*, 105: 406, 1935.

Stern, E. L. Relief of intractible pain by the intraspinal (subarachnoid) injection of alcohol. *Am. J. Surg.*, 25: 217 (Aug.) 1934.

Pitkin, G. P. Controllable spinal anaesthesia. *Jour. Med. Soc. N. J.*, 1927.

Aird, R. B. and Naffziger, H. C. Experimental injection of ethyl alcohol into the lumbar subarachnoid space with neuropathological studies. *Western Jour. Surg. Obst. and Gynec.*, (July) 1935.

Vreden, R. R. Anomalies of the lower spine: consequences and treatment. *Orth. i. Traumatologia*, 4: 5, 1931.

Olmsted, J. M. D. and Hodgson, P. An explanation of the results of the "Alcohol Block." *Am. J. Physiol.*, 97: 597 (July) 1931.

INTRAPERITONEAL USE OF AMNIOTIC FLUID TO PROMOTE SMOOTHER POSTOPERATIVE CONVALESCENCE*

J. RANDOLPH GEPFERT, M.D.

NEW YORK CITY

A POSTOPERATIVE convalescence which should be smooth and uneventful is frequently made stormy by nausea, vomiting, distention and gas pains. These are a source of annoyance to the patient varying from discomfort to excruciating pain; to the surgeon they are the possible forerunners of dangerous complications.

On the Gynecological Service at Bellevue Hospital the usual treatments for these conditions have failed to give uniformly good results. In an attempt to solve the problem, recent literature was reviewed for suggestions as to prevention and treatment, and it was found that Johnson[1] in 1928 and Trusler[2] in 1931 had reported some interesting facts. During their independent studies of amniotic fluid as a modifier of peritoneal adhesions, they observed that the patients and experimental animals receiving amniotic fluid intraperitoneally at the time of operation, had a smoother convalescence. The preparation used for intraperitoneal use of amniotic fluid was "amfetin," (Lilly), a concentrated sterile fraction of bovine amniotic fluid. The source, collection and preparation of this concentrated fraction is amply discussed in a recent article by Johnson.[3]

The clinical work on amfetin was preceded by a small series of control experiments with dogs weighing from 10 to 15 kilograms. In each case the peritoneal cavity was entered through a right rectus incision, the parietal peritoneum, stomach and intestines scarified with a sharp scalpel and several pieces of peritoneum 1 cm. wide and 5 cm. long stripped off adjacent loops of intestines. The whole traumatized area was then liberally swabbed with half strength tincture of iodine, after which 100 c.c. of amfetin were introduced into the peritoneal cavity of the experimental animals and an equivalent amount of normal saline into the controls, incision in both cases being closed in layers. Morphine hypodermically followed by inhalation ether were used as anesthetic agents. The peritoneal cavity was opened in each case three weeks after operation and results carefully tabulated. The animals treated with amfetin withstood an average of two and one-half such operations before death, while the controls withstood an average of one and one quarter operations. Our observations on adhesions in these animals coincided with Lacey's[4] views; following the initial operation the adhesions in the treated animals were almost as numerous as in the controls but were definitely less dense and easier to separate. Repeated separation of adhesions followed by the use of amfetin, each time resulted in fewer and thinner adhesions, while in the controls the adhesions became more numerous and denser.

The general appearance of the treated animals was uniformly and obviously better than that of the controls; the animals in the former group were more active, had a more normal posture, and evinced a normal appetite sooner than the controls. It was concluded from this small series that the intraperitoneal use of amfetin was safe and possibly beneficial.

The clinical use of amfetin was then begun. It was used entirely at the time of

* From the Department of Obstetrics and Gynecology, New York University College of Medicine and the Obstetrical and Gynecological Service of the Third (New York University) Surgical Division Bellevue Hospital.
Read before the Society of Alumni of Bellevue Hospital, New York, May, 1935.

operation, the technique of administration being briefly as follows: The fluid was heated in the stock bottle to 100°F., the cap and neck of the bottle then wiped off with alcohol, the cap removed and the fluid introduced into the abdomen through a funnel, immediately preceding the tying of the last peritoneal suture. The amount used varied from 200 to 400 c.c. In most cases the latter amount was found to be the optimum. It was advantageous to have the patient in Trendelenberg position during the instillation.

The present study was conducted on the Gynecological Service at Bellevue Hospital, where there is a predominance of extensive and severe pelvic pathology such as is not encountered to any extent in the usual hospital patient. This fact is mentioned only to emphasize our belief that any favorable results obtained should be interpreted liberally, because of the primary handicap imposed by the type of pathology encountered at operation in treated cases.

Of 100 consecutive laparotomies, the 50 patients showing the most marked pelvic pathology at the time of operation, were selected for treatment with amfetin. The remaining 50 of the series were used as controls. The surgeons for the most part were the same, so that no question of individual ability need arise. The anesthetist, anesthetic agent, preoperative preparation and postoperative nursing care were essentially the same in both groups. The series of treated patients includes three deaths, which will be discussed later. The results obtained in the cases given amfetin were analyzed and compared with the controls in the following tables.

In Table I the diagnoses in the two groups of patients are compared, but does not take into account the complicating factors, notably adhesions, which were found at operation. It will be noted that there is a preponderance of adnexal pathology in the amfetin group, whereas 50 per cent of the control group is composed of uncomplicated uterine fibroids.

In Table II the operations performed in the two groups are compared. It will be seen from this table that, anatomically speaking, the types of operations in the two groups were very similar.

Table I
DIAGNOSES

	Amfetin	Control
Retroversion uteri and chronic adnexal	5	2
Old ectopic	3	0
Carcinoma of ovary	3	1
Postoperative adhesions and chronic adnexal	2	1
Chronic adnexal	15	8
Fibroid uterus	9	25
Fibroid uterus and chronic adnexal	10	4
Ovarian cyst	3	5
Ectopic	0	3
Carcinoma of fundus	0	1

Table II
OPERATIONS

	Amfetin	Control
Suspension of uterus	2	6
Supracervical hysterectomy	3	2
Supracervical hysterectomy and unilateral salpingo-oophorectomy	5	8
Supracervical hysterectomy and bilateral salpingo-oophorectomy	13	19
Bilateral salpingo-oophorectomy	6	1
Unilateral salpingo-oophorectomy	13	4
Unilateral salpingectomy	4	3
Turpentine injection of tubes	3	1
Exploratory laparotomy	1	2
Myomectomy	0	3
Sovak reconstruction	0	1
	50	50

Table III
ADHESIONS

	None Per Cent	Fine Per Cent	Moderate Per Cent	Dense Per Cent	Total with Adhesions Per Cent
Amfetin	12	4	10	74	88
Control	64	16	10	10	36

In Table III the extent and density of adhesions found at operation in the two

groups are compared. Of the cases given amfetin 80 per cent had adhesions present, while only 36 per cent of the controls were thus complicated and these to a much less extent, while 74 per cent of the amfetin group had dense adhesions only 10 per cent of the controls were similarly complicated. From this analysis we would expect a much smoother postoperative convalescence in the control group, for operation on the amfetin group definitely entailed more extensive and more traumatic surgery.

Table IV
GENERAL DATA

	Amfetin	Control
1. Average age of patient	35	37
2. Average operation time	52 Minutes	56 Minutes
3. Average postoperative day of voiding	2.25	3.1
4. Average postoperative blood pressure	98/67	108/70
5. Average postoperative complications	18 per cent	12 per cent

In Table IV is presented general information, as to the average age of the patients in the two groups, average operating time, postoperative day of voiding, postoperative blood pressure and a comparative percentage of postoperative complications. Wound infections in both groups were the same, all being superficial but one, a deep intramural abscess occurring in a control case. In the amfetin cases 4 patients had bronchitis, 2 pneumonia, and one each of hemolytic septicemia, pyelitis and general peritonitis, making a total of 9 complications or 18 per cent. These include the 3 deaths mentioned. In the control cases there were 2 pneumonias and one each of intestinal obstruction, bilateral otitis media, thrombophlebitis of the leg, and sinus tachycardia, making a total of 6 or 12 per cent.

In Table V is compared the average temperature and pulse rate for each of the first four postoperative days, reactions being less in the amfetin group. This was probably due to an early return of the normal motility of the gastrointestinal tract, plus repression of any low grade peritoneal infection. Following the work of Young and Marks[6] the latter explanation seems more feasible.

Table V
TEMPERATURE AND PULSE FIRST FOUR POST OPERATIVE DAYS

	Amfetin		Control	
	Temperature	Pulse	Temperature	Pulse
1st 24 hours	99.6	99	100.2	106
2nd 24 hours	100.8	101	102.2	114
3rd 24 hours	100.7	102	101.0	104
4th 24 hours	100	97	100.3	103

Table VI

NAUSEA	Amfetin Per Cent	Control Per Cent	VOMITING	Amfetin Per Cent	Control Per Cent
Slight	32	28	Slight	30	22
Moderate	6	22	Moderate	4	22
Severe	2	6	Severe	2	6
Total	40	56	Total	36	50

DISTRIBUTION	Amfetin Per Cent	Control Per Cent	GAS PAINS	Amfetin Per Cent	Control Per Cent
Slight	26	38	Slight	22	22
Moderate	6	11	Moderate	14	50
Severe	2	22	Severe	2	11
Total	34	71	Total	38	83

In Table VI is compared the amount of nausea, vomiting, distention and gas pains in the two groups of patients. It may be well to stress the fact that though the "slight" columns of both groups are

similar, the "moderate" and "severe" columns show a marked contrast, favoring the amfetin group. This would seem to indicate that amfetin prevents the occurrence of the usual percentage of "slight" complaints and decreases the severity of those "moderate" and "severe" cases to the point where they fall under the "slight" classification. This is shown by the fact that while the average of the "slight" columns in the amfetin and control groups is 27.5 per cent, in the "moderate" column the average of the amfetin group is 7.5 per cent and under the control it is 26 per cent; in the "severe" column of amfetin the average is 2 per cent and in the controls, 11.5 per cent.

In addition to these tabulated facts it has been definitely established that the patients receiving amfetin were able to take and retain fluids and food earlier and in larger amounts than the control group. They were also able to void and pass flatus earlier, unassisted by the usual methods. The amfetin group in many ways seemed happier and in better general condition than did the controls. It was also observed that the postoperative posture of the patients in the amfetin group approximated more nearly normal than did the control patients. The hospitalization period was the same in both groups due to the hospital routine, but the amfetin group desired to be out of bed sooner, in spite of the fact that they had been subjected to more extensive surgery than had the control patients. During the course of clinical observations on amfetin, in 6 patients operated, 400 c.c. sterile saline solution were introduced into the peritoneal cavity, to determine whether the results obtained with amfetin might be due to the presence of a fluid in the peritoneal cavity. The reaction of these patients was no different than that of a similar group of patients having the same type of operation, followed by a hypodermoclysis of 400 c.c. of normal saline.

The three deaths which occurred in the amfetin group were as follows:

Case I. Colored female, age thirty-eight, was in the hospital twenty-eight days preoperatively with fourteen consecutive days of normal temperature, pulse and blood work. A fibroid uterus and chronic adnexal disease necessitated a supracervical hysterectomy, bilateral Salpingectomy, and a left Oophorectomy. A fibroid uterus, size of twenty-four weeks gestation and a left pyosalpinx were found. At the time of operation 400 c.c. of amfetin were introduced into the peritoneal cavity. The patient ran a septic temperature and expired seventy-two hours later. Blood culture taken twenty-four hours postoperatively was positive for hemolytic streptococcus. There were no signs of peritonitis. Postmortem abdominal tap was dry. There was no nausea, vomiting or distention until two hours antemortem. No autopsy was obtainable.

Case II. Colored female, age thirty-two with diagnosis of fibroid uterus and chronic adnexal disease was operated doing a supracervical hysterectomy and bilateral salpingo-oophorectomy, introducing 400 c.c. of amfetin at the time of operation. Patient died on the fourth postoperative day of a right middle and lower lobar pneumonia. Blood culture was positive for type v pneumococcus. There was no nausea, vomiting or distention until the day of her death.

Case III. White female, age thirty-seven, admitted with a draining colpotomy wound of two years duration. This was healed by local treatment and patient sent for two months rest. She was readmitted with a history of constant vaginal bleeding and pelvic pain of six weeks duration. Temperature, pulse and blood count were normal in spite of repeated pelvic examinations. At operation, the entire pelvis was found to be filled with intestines, fibroid uterus and tubo-ovarian masses, all bound together by numerous bands of dense adhesions. The adhesions were separated, and a supracervical hysterectomy and bilateral salpingo-oophorectomy was performed. The odor of pus was detected at operation, but its source could not be located. Prior to abdominal closure 400 c.c. of amfetin were introduced. The patient developed general peritonitis and died on the fourth postoperative day. Autopsy revealed acute general purulent peritonitis, numerous filmy adhesions being seen throughout the abdomen. No evidence of amfetin was found. Nausea, vomiting and distention were pro-

nounced during the most of her postoperative period.

This is only a preliminary report, as the study is being continued. We hope to report a larger series of cases, with laboratory work to supplement the study.

CONCLUSIONS

1. A concentrated sterile fraction of bovine amniotic fluid (Amfetin, Lilly) can safely be employed intraperitoneally following abdominal surgery.

2. When so used it promotes a smoother postoperative convalescence, with less nausea, vomiting, distention and gas pains.

3. The optimum amount to be used in the average case is 400 c.c.

4. It should not be used at the time of operation if the presence of pus is suspected.

5. It definitely hastens the patient's return to normal physical activity.

REFERENCES

1. Johnson, Herbert L. Amniotic fluid concentrate in prevention of adhesions, *New England J. Med.*, 199; 661, 1928.
2. Trusler, H. M. Peritonitis: an experimental study of healing in the peritoneum and the therapeutic effect of amniotic fluid concentrate, *Arch. Surg.*, 22: 983, 1931.
3. Johnson, Herbert L. Amfetin: its influence upon defense and repair in serous cavities, *Med. Arts*, 36: 409, 1935.
4. Lacey, James T. Prevention of peritoneal adhesions by amniotic fluid, *Ann. Surg.*, 92: 281, 1930.
5. Warren, S. Effects of amniotic fluid on serous surfaces, *Arch. Path.*, 6: 860, 1928.
6. Young, Edward, L. Jr. and Marks, George A. Preoperative preparation of the peritoneum in surgery of the large intestine. *Surg. Gynec. Obst.*, 59: 610, 1934.

REFERENCES OF DR. ABESHOUSE*

Albarran. Medecine Operatoire des Voies Urinaries. Paris, 1909.

Alcock, N. G. Ten months experience with transurethral prostatic resection. *J. Urol.*, 28: 545, (Nov.) 1932.

Alyea, E. P. Vaso-ligation, a preventative of epididymitis before and after prostatectomy. *J. Urol.*, 19: 65, 1928.

Aschner, P. W. Observations on suprapubic prostatectomy. *J. Urol.*, 12: 251, 1924.

Aschner, P. W. In discussion of Read and Morgan's article.

Ballinger, E. G., Elder, O. F., and McDonald, H. P. An analysis of eighty-two transurethral prostatic resections. *Bull. of Crawford W. Long Memorial Hosp.*, (Nov. 30) 1932.

Burgess, A. H. Murphy, and some principles of urinary surgery. *Surg., Gynec. Obst.*, 54: 257, (Feb.) 1932.

Cashman, G. A. Vaso-ligation in cases of prostatic obstruction. *N. Y. State J. Med.*, 15, 30: 1364, (Nov.) 1930.

Collings, C. W. Electrotome excision of prostatic bar. *J. A. M. A.*, 90: 438, (Feb. 11) 1928.

Colston, J. A. C. Vaso-ligation for the prevention of pre-operative and postoperative epididymitis. *J. A. M. A.* 90: 526, 1928.

Crabtree, E. G. and Brodney, M. L. Vasectomy in prostatic surgery; review of 141 consecutive prostatectomies. *Trans. Am. Ass. Genito-Urin. Surg.*, 23. 383, 1930.

Crockett, F. S. and Washburn, W. W. Progress of the prostatic after he has left the hospital. *J. Urol.* 26: 643, (Nov.) 1931.

Dorman, H. N. Personal observations in prostatic resection. *J. Urol.*, 29: 361, 1933.

Engel, W. J.: Transurethral operation for relief of bladder neck obstruction. *Urol. & Cutan. Rev.* 36: 180, (Mar.) 1932.

Goldstein, A. E. Bilateral ligation of the vas deferens in prostatectomy. *J. Urol.*, 17: 25, 1927.

Haines, W. F. A preliminary report of one year's experience with transurethral prostatic resection. *Urol. & Cutan. Rev.*, 37· 298, (May) 1933.

Keyes, E. L. Urology. N. Y., Appleton, 1928; p. 602.

Keyes, E. L. The preventable infections incident to preparing a prostatic patient for operation. *Trans. Chicago Urological Soc.*, 1: 5, 1931.

McKay, H. W. Bilateral ligation of the vas as a prevention of epididymitis in prostatectomy. *Southern Med. J.*, 21: 799, 1928.

McKenna. In discussion of Read and Morgan's article.

Meltzer, M. Bilateral vasectomy for prevention of epididymitis in prostatism. *N. Y. State J. Med.*, 28: 1290, (Nov. 1) 1928.

Morson, A. C. Some problems of prostatectomy. *Practitioner, London*, 110: 253, 1923.

Morson, A. C. Division of the vas deferens in prostatectomy. *Brit. Med. J.*, 2: 1032, 1923.

O'Neil, R. F. Clinical observations on vasectomy in prostatic surgery. *Trans. Am. Assoc. Genito-Urin. Surg.*, 22: 267, 1929.

* *Continued from p. 17*

TREATMENT OF SPRAINS BY INTERLIGAMENTARY INJECTION OF NOVOCAINE

RENÉ LERICHE, M.D. AND G. ARNULF, M.D.

Professor of Surgery, Clinique Chirurgicale A., University of Strasbourg

STRASBOURG

Interne, Hotel Dieu

LYON

DURING the last few years we have treated all mild sprains by the interligamentary injection of novocaine with consistently excellent results. The traumatized joint usually responds quickly to treatment, often requiring but a single injection, and we find that the relief is permanent. Since we believe that we are able to effectively suppress the troubles which lead to prolonged functional weakness of a joint, we present this short discussion based entirely upon our clinical experiences and observations.

THEORETICAL BACKGROUND

Many classical treatises dismiss a sprain in vague terms as the consequence of a sudden, exaggerated execution of articular movements. This may explain how a sprain is produced but to us the important feature is why there is functional impotency of the articulation. In many cases a sprain is accompanied by torn ligaments or possible fracture, either of which if present, adequately explains the functional disability. *X*-ray examination should be employed to establish the presence or absence of fracture, and occasionally ligamentary displacements or tears if present can be discovered while cleaning a superficial wound. It is our belief however, that many and perhaps most of the common sprains do not involve an actual ligamentary tear. Why then, do we so often find serious functional troubles following sprains?

Histologically, the articular ligaments are well endowed with sensitive corpuscles. Rauber in 1865, emphasized the rich nervous tissue of ligaments and later studies have shown that they possess as many sensitive corpuscles as the skin. This is logically expected when one recalls that series upon series of automatic regulatory impulses emenate from the rich nervous supply in the region of an articulation.

In sprains the ligamentary trauma is accompanied by a violent excitation of this rich nerve supply; the functional impotence following immediately as a direct consequence. Thus if one suppresses the nerve irritation by means of a local anesthesia of the ligament, the normal functional state is restored. Whence, we conclude "*that a sprain is the reflex consequence of trauma, and specifically the result of a distortion of the nervous apparatus present in the articular ligaments.*"

In cases with edema, local hyperemia and even articular effusion present one may suspect vasomotor troubles as a cause, whereupon careful vascular examination is indicated. Thus, this new conception of a sprain has led us to try the treatment of interligamentary injections with surprising results.

TECHNIQUE

(1) Injection of 10 to 20 c.c., according to the importance of the articulation, of a 1 per cent solution of novocaine in the region of the traumatized ligament. The point designated for the injection is the spot of maximum tenderness but care is also taken to inject the ligament itself.

(2) Material ordinarily used for local anesthesia; a fine needle and an ordinary syringe.

(3) Ligaments of the knee, wrist, ankle and shoulder are usually easy to locate. For the hip, however, the injection is more

difficult. For this articulation one succeeds in avoiding the large vessels by introducing the needle to the neck of the femur, withdrawing it about 1 cm. and then making the injection. The use of a fine, long, flexible needle facilitates the injections, allowing one to surround the osseous tuberosities, thus obviating the necessity for repeated skin punctures.

(4) The results are immediate and the attempts of the patient at mobilization in the first quarter of an hour indicate if the injection is sufficient. If the pain and disability still persist, another injection in the region remaining painful is made, so that the total quantity injected does not exceed 25 or 30 c.c. After several moments the patient is asked to gently move the joint and quite generally he is astonished to find an almost normal painless movement. Cautiously at first, the patient later moves without hesitation when he no longer feels pain. Ordinarily a single injection suffices, but if not, repeated infiltrations during the subsequent few days are made.

(5) Accidents in using this technique have never caused alarm, for the puncture of a blood vessel, which should rarely happen, is quite harmless. In order to be certain that novocain is not injected into a vessel one must withdraw the plunger of the syringe, or be certain that no flow of blood comes from the inserted needle. Injections into a joint cavity likewise incurs no risk providing one has observed the rules of strict asepsis. We should however, mention one feature: the patient should always be warned to expect increased pain about one to two hours following injection. This is caused by the increase in blood supply to the tissues infiltrated with novocaine, but it usually disappears in a short time, and leaves the articulation free from pain.

INDICATIONS

We have used this method of treatment in all types of ligamentary sprains in which no fracture or torn ligament could be demonstrated. Sprains may be treated at all stages of development, but the results are more satisfactory in the early stages; older sprains given only inconstant results. We have divided the conditions in which this method of treatment, in our hands, has given good results, into three groups:

(1) Those patients who have an *articular impotence as the result of a sprain* in which there is no fracture, as demonstrated by *x*-ray examination, and where no torn ligaments can be identified. It has been our experience that ligamentary tears can be recognized by the presence of abnormal articular laxity. If these cases of mild sprain are infiltrated during the hours immediately following the accident there is a lasting relief of symptoms with only one or two injections in the first twenty-four hours. Hydrarthrosis or a slight local ecchymosis without fracture is not a contra-indication, and usually there is neither atrophy nor edema as a result of the injections.

(2) *The after-effects of sprains*, namely pain and muscular atrophy, may also be treated by this method. These phenomena disappear with the infiltration of the ligament, and muscular force may be augmented immediately after the injection, as we have noted in a case of sprained wrist by measuring the force of the hand by means of a dynamometer.

(3) *Following joint operations*, in the course of which surgical maneuvers have created what we term an "operation sprain," the infiltration of the strained ligaments will hasten the return of the articulation to normal.

From our clinical experience we believe that most of the common sprains do not involve serious tears of the supporting ligaments, and that infiltration affords a speedy relief of the symptoms which cause prolonged disability and suffering. Hence we have been careful not to include torn ligaments and fragmentary fractures in our category of sprains. In these cases pain is Nature's means of protecting a seriously injured joint, and since we believe that

these cases can be recognized, immobilization should be the treatment of choice. Although not dangerous in itself, the infiltration of torn ligaments or accompanying fractures is not conclusive of results. Its very ineffectiveness, however, may guide one toward a diagnosis of fracture or articular laxity with the increased facility of examination after a local anesthesia. In one case which we have seen, an injured rugby player, whose knee ceased to pain him after infiltration, revealed at the same time a serious articular laxity. Thus in this case we were guided toward a treatment of torn ligaments and not of sprain.

In general this treatment should interest athletes among whom sprains are very common. We believe that a supply of novocaine and the material necessary for its injection should be found in every athletic center. By this treatment, one can easily and at little cost, spare the suffering and time lost for those with sprains.

SUMMARY

As the result of clinical experience and study we have found that the interligamentary injection of novocaine satisfactorily relieves symptoms and speeds the healing of sprains, where no associated fracture or ligamental tear can be demonstrated. This treatment is based upon the conception that local anesthesia of the irritated, complex nervous elements of injured articular ligaments, quickly restores the functional state and greatly reduces the otherwise prolonged convalescence. The technique, results and contraindications are discussed. The best results are obtained in: (1) simple sprains with articular impotence but when no fracture or torn ligaments are found, (2) patients suffering from the after-effects of sprains, namely pain and muscular atrophy, and (3) orthopedic cases where surgical maneuvers may have strained the ligaments about a joint resulting in what we have termed an "operation sprain." This simplified form of treatment should be of special value in athletic centers where sprains are common.

REFERENCES

Arnulf and Frieh, P. Traitement immédiat des traumatismes articulaires sans fracture par les injections intraligamentaires de novocaine, *Presse méd.* 42: 597–599 (April 14) 1934.

Bernard, Etienne, Marie. Traitement des Séquelles des contusions articulaires (et des entorses, banales). These pour le doctorat en Medecine (diplome D'etat) Paris Année 1933 (librairie, Louise Arnette 2.) (Rue Casimir-Delavigne 2.)

Gusmal, Ismael. O Methodo de Leriche no tratamento das entorses e arthrites traumatices.—*Revista medicina e Cirurgia*, Rio de Janeiro, (Oct.) 1934.

Leriche, R. Des effets de l'anesthésie a la novocaine des ligaments et des insertions tendineuses périarticulaires dans certaines maladies articulaires et dans les vices de position fonctionels des articulations. *Gazette des Hôpitaux*, 103: 1294, 1930.

Leriche, R. Recherches sur le rôle de l'innervation sensitive des articulations et de leur appareil ligamentaire dans la physiologie pathologique articulaire, *Presse méd.* 38: 417–418 (March 26) 1930.

Leriche, R., and Fontaine, R. De la valeur thérapeutique des infiltrations péri-articulaires à la novocaine dans les entorses et les arthrites traumatiques. *Presse, Méd.* 40: 280–282 (Feb. 20) 1932.

Leriche, R. Qu'est-ce qu'une entorse? *Bull. et mém. Soc. Nat. de chir.*, 60: 365–373 (March 3) 1934; also, *Gaz. d. hôp.* 107: 325–328 (March 7) 1934.

Magione, G., and Buglairi, R. G. Sul trattamento con infiltrazione novocaine dei traumatismi articolari, *Minerva méd.* 2: 885–892 (Dec. 22) 1934.

Perard et Chatel. Le traitement des entorses. *Maroc Médical*, 15, 151: 17, (Jan.) 1935.

FASCIA LATA REPAIR OF SLIDING HERNIAS

ALFRED H. IASON, M.D., F.A.C.S.

Assistant Clinical Professor of Surgery, Long Island College of Medicine, Attending Surgeon, Jewish and Beth El Hospitals

BROOKLYN, N. Y.

ONE of the most difficult hernias to repair because of its peculiar anatomy and physiology, is a "sliding hernia" (Fig. 1) or, as the writer believes it should be called, "prolapse of the colon." In many cases calamities have ensued because of failure to recognize certain cardinal principles underlying the repair of this somewhat unusual condition. A clear concept of the embryology and anatomy of this defect or anomaly is a sine qua non of the armamentarium of one who does a large number of hernias.

In closing an inguinal defect it is desired to obliterate as much of the gap as possible without encroaching too closely upon the cord and its structures, especially the internal and external spermatic and deferential vessels, the pampiniform plexus and the vas deferens. When a "sliding hernia" is encountered, and attempt to utilize the presenting structures is fraught with danger.

When a peritoneal investing layer has a sessile attachment to the posterior abdominal wall, we say the enveloped organ is partly retroperitoneal, as the pancreas or retroperitoneal part of the duodenum. On the other hand, when the peritoneal attachment is narrower, we say that the organ has no mesentery and that it is partly extraperitoneal. Finally, in cases where the organ is almost completely invested so that the two leaflets of the peritoneal sheath are almost in contact posteriorly, one describes the viscus as having a mesentery. (Fig. 1*a*, *b*, *c*.)

The cecum is the commonest offender in "sliding hernias" and may be classed in any of the three divisions; fortunately it is usually in the third class and for that reason we do not see so-called "sliding hernias" so often.

The cecum and appendix often have a complete peritoneal investment, so that they lie free in the right iliac fossa. The usual line of fixation of the ascending colon starts at the beginning of that viscus.

The ileocolic artery supplies the blood to the cecum, the beginning of the ascending colon, appendix and lower ileum. The ileocolic artery arises from the superior mesenteric artery just below the transverse portion of the duodenum and runs downward and dextrolaterally toward the ileocecal angle and divides into four terminal branches:

(1) Anterior cecal, (2) posterior cecal, (3) appendiceal, and (4) ileal artery to lower ileum.

The veins are tributaries to the superior mesenteric trunk.

There are four varieties of prolapse of the colon:

(1) Mobile cecum lying low in pelvis with a relaxed mesentery, and very loose retrocecal and retroperitoneal areolar tissues. (Fig. 2.)

(2) Mobile cecum presenting the same pathology as (1), but the cecum, and even the appendix, enter a preformed open funicular process of the peritoneum in the inguinal canal. (Fig. 2.)

These two classes occur in those with a definite mesentery, as in Figure 1*c*.

(3) A cecum that has a broad attachment resembling mesentery may prolapse enough to present itself at the deep ring.

The sac is incomplete over the unattached area of bowel behind it. This type occurs in those cecums having a broad mesentery, as in Figure 3; and may eventu-

ally become similar to the next class, also Figure 1*b*.

(4) When the prolapse is complete no real sac is present, there is no mesentery the cecum being almost completely extraperitoneal. It slides down extraperitoneally, so to speak, with its serous peritoneal covering intact and presents itself at the deep ring. The bowel may very readily be mistaken for a hernial sac and inadvertently opened. (Fig. 3 and Fig. 1*a*.)

In the repair of this condition our attention must be confined to classes 3 and 4.

In class 2, no more difficulty is experienced than in the usual hernia procedure.

In the third type there is a deficiency in the sac posterolateral to the cecal wall, which is presenting. (Fig. 3.) In an attempt to ligate the sac high up, there are two dangers; one is an accidental puncture of the cecal wall (Fig. 1) and, secondly, the more common danger of encroaching on the posterolateral aspect of the cecum as to ligate the cecal vessels. (Fig. 3.)

In the fourth type, an additional hazard is the failure to recognize the cecal bulge as cecum, and believing that a sac is presenting, thus incise or plicate the gut with the expected dire results.

In the past we have been content to reposit the bowel as well as possible and then perform some type of hernioplasty, at the same time being apprehensive lest damage be done to the bowel or cord structures. Consequently, the hiatus at the deep ring was only incompletely narrowed, with resultant postoperative defect. Or shall one say that the original defect was never corrected?

In the appended 7 cases, the following procedure was followed:

After exposing the inguinal canal and mobilizing the structures about the deep ring, a wide strip of the tensor fascia lata was brought up subcutaneously, insinuated through two longitudinal slits of the inguinal ligament, to which it was tacked with a No. 1 chromic single catgut on a Lilienthal needle sutured at the point where it entered the hiatus in the inguinal ligament. (Fig. 4.) The iliotibial band distal to this point was split longitudinally. The lateral segment was tacked with the same type suture and needle to the lowest part of

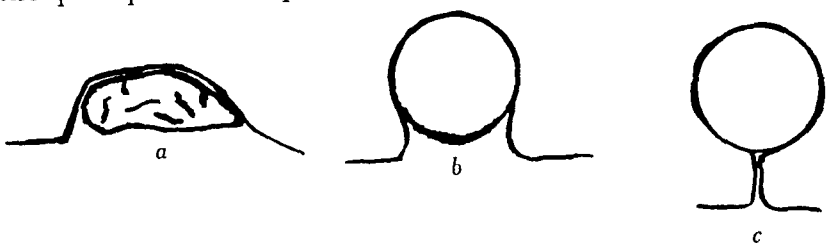


Fig. 1. *a*. Pancreas, retroperitoneal. Some cecums have this attachment. *b*. Ascending colon. No mesentery. *c*. Jejunum. Mesenteric attachment.

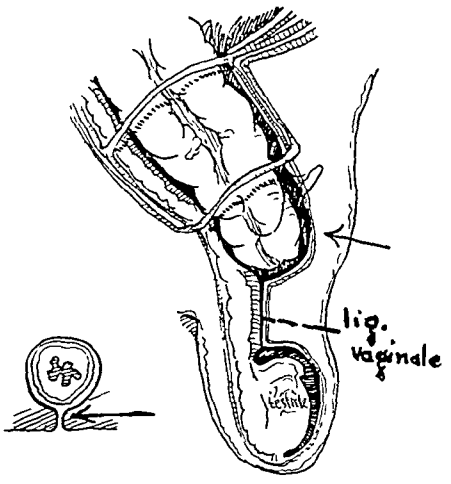


Fig. 2. Cecum in hernia sac.

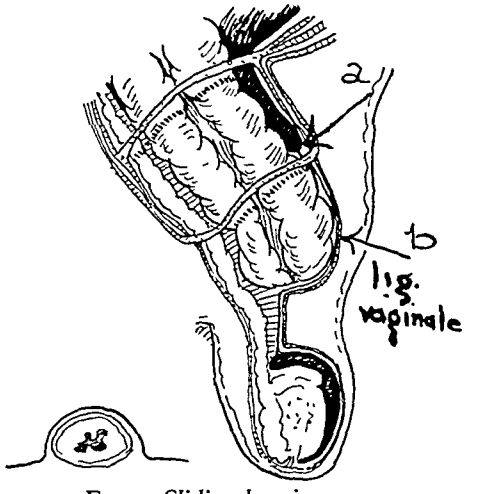


Fig. 3. Sliding hernia; no sac.

the mesentery of the cecum and the contiguous deep surface of the upper and lower leaflets of the previously split external

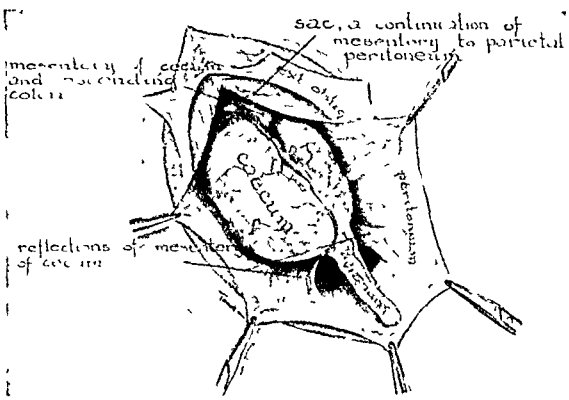


Fig. 4. Sliding hernia.

oblique aponeurosis, including in this suture the conjoined tendon. The medial leaflet of the iliotibial band was then sutured to the upper leaflet of the external oblique aponeurosis and conjoined tendon close to the cord using the same technique. The external oblique aponeurosis was then approximated in the usual manner with nterrupted chronic No. 1 single sutures. (Fig. 4.) The skin of the groin and thigh was then closed in layers.

The same anatomical processes operate in a prolapse of the sigmoid or "sliding hernia" on the left side. A similar procedure is used in this instance.

SUMMARY

To date there has been no satisfactory operative procedure for sliding hernias. In the writer's experience recurrences have been very frequent. Because of the danger of encroachment upon the blood supply a satisfactory repair is difficult. A new procedure is thus devised which has proved satisfactory.

COMMENT

(1) Seven cases of cecal prolapse or so-called "sliding hernia" are presented.

CASE REPORTS

Name and Number	Age	Sex	Previous History	Operation and Findings	Result
(1) M. C.	54	F	Mass in right groin ten years, reducible. Increasing in size lately.	Indirect inguinal hernia, right, with cecal prolapse. Poor musculature.	Excellent
(2) H. S.	64	M	Right inguinal reducible mass fifteen years. Tremendous increase in size recently.	Right indirect inguinal hernia, with cecal prolapse. Myofibrosis of falx aponeurotica.	Excellent
(3) I. C.	62	M	Right inguinal mass ten years. Tremendous increase in size in last five years.	Right indirect inguinal hernia. Cecal prolapse. Bulge in Hesselbach's triangle.	Excellent
(4) S. C.	58	F	Right inguinal mass twelve years. Large increase in last five years.	Right indirect inguinal hernia. Defect in Hesselbach's triangle. Myofibrosis of falx inguinal.	Excellent
(5) A. C.	60	M	Right inguinal mass fourteen years. For past two years has grown to size of an orange.	Right inguinal hernia with bulge in Hesselbach's triangle. Weak musculature. Cecal prolapse.	Excellent
(6) H. A.	65	M	Right inguinal mass fifteen years. Increasing in size.	Right inguinal hernia. Weak musculature. Cecal prolapse.	Excellent
(7) H. S.	66	M	Left inguinal mass twenty years. Increasing in size.	Left inguinal hernia. Weak musculature. Prolapse of sigmoid colon.	Excellent

(2) A new operative technique is devised.

(3) Results to date are excellent.

(4) At least eight months have elapsed since the most recent case reported here.

CUTTING PRETHYROID MUSCLES FOR EXPOSURE IN THYROIDECTOMY

HOWARD M. CLUTE, M.D., F.A.C.S.

BOSTON, MASSACHUSETTS

IT is generally conceded that in thyroid surgery adequate exposure of the operative field is of primary importance. Full view of the lateral and posterolateral surface of the thyroid permits the operator actually to see the parathyroids in a majority of the cases, and to note the course of the recurrent laryngeal nerve, and, to visualize the trachea. With these structures in view their injury is readily avoided. Such exposure, in my experience, is best obtained by cutting the prethyroid muscles.

For various reasons cutting the prethyroid muscles is not generally practiced. It is felt that this unnecessarily injures these important muscles and may result in a deformity in the neck, and that good exposure can be obtained by retracting these muscles to one side. Increased operating time and an additional chance of postoperative collections of serum in the wound are also stated as reasons against cutting these muscles.

Cutting the prethyroid muscles, especially by the technique here described, gives no deformity in the end result. From an experience with several thousand operations on the thyroid, I am satisfied that normal function returns to these muscles after they are cut and atrophy does not occur when their main nerve supply is preserved. It is a common experience at secondary thyroid operations to find little evidence of the previous procedure, except a linear scar in the muscles. Repeated examinations of patients months and years after operation show no deformity or loss of adequate function.

The deeper of the two prethyroid muscles is the sternothyroid. This muscle is inserted into the oblique line of the thyroid cartilage and overlies, and is often adherent to, the superior pole and upper lateral surface of the thyroid gland. Adequate exposure of this superior portion of the thyroid gland is practically impossible in many cases by retraction of this muscle alone. The pole lies in such close association to the insertion of the muscle that the muscle must be torn from this insertion if the pole is visualized. Large pieces of

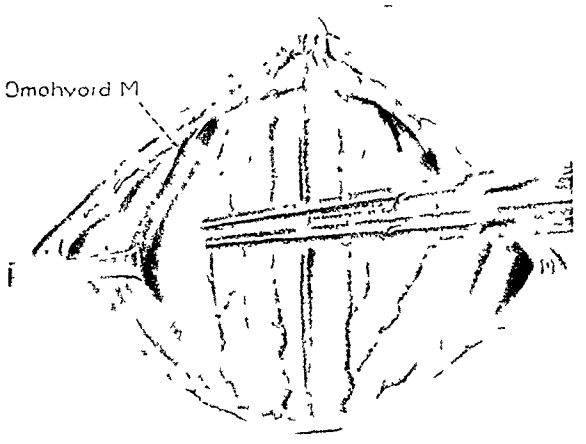


FIG. 1. The sternomastoid muscle has been retracted. Ochsner clamps are placed on the prethyroid muscles about an inch below the oblique line of the thyroid cartilage. Care is taken not to extend the clamps so far laterally that the ansa hypoglossi nerve or the omohyoid muscle is cut.

thyroid tissue may be left if full vision of the pole is not available.

The nerve supply of the sternothyroid, sternohyoid and omohyoid muscles enters through fibres of the ansa hypoglossi. This nerve enters the muscles at their lower extremities after making a long loop down the neck. Its course is readily visible when the sternomastoid muscle is retracted, lying in the lateral surfaces of the prethyroid muscles. (Fig. 2.) Care must be used to avoid cutting the main trunk of the hypoglossal loop when the prethyroid muscles are clamped and cut, by not extending the clamps too far in the lateral direction. (Fig. 1.) If the main branches of this nerve are thus preserved, muscle tone in the prethyroid muscles will not be lost, and postoperative atrophy will not occur.

Operators differ as to the level at which these prethyroid muscles should be clamped and cut. Some believe that the clamps should be placed on the muscles as high as possible to avoid all the nerve branches possible which enter the lower ends of the muscles. Clamping the muscles high, how-

ever, results in having only a short frayed end of the deep muscle remaining on the oblique line of the thyroid cartilage. This

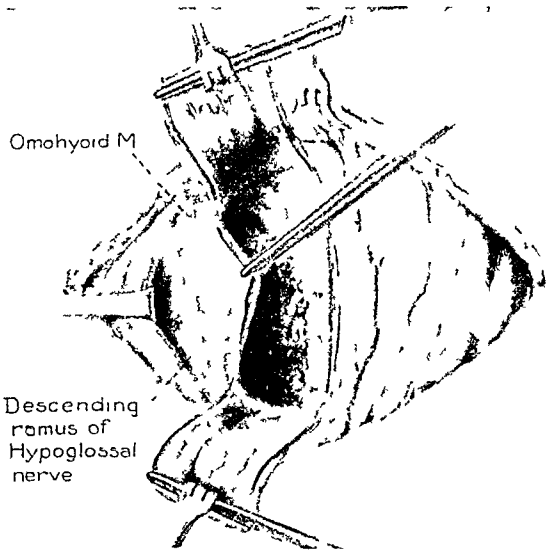


FIG. 2 Ready for closure after hemithyroidectomy. Note the uncut lateral portion of the sternohyoid and sternothyroid muscles. Note the course of the ansa hypoglossi nerve which can usually be clearly seen and avoided.

prohibits proper suture of this muscle after the operation. The clamps can be safely

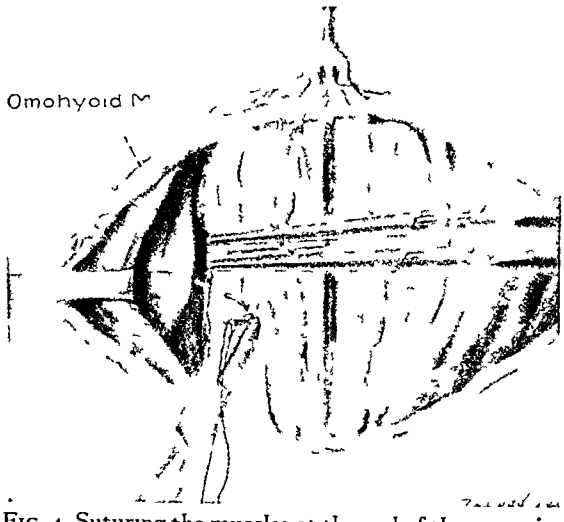


FIG. 4. Suturing the muscles at the end of the operation The omohyoid is available to obliterate the lateral gap left by folding in some of the prethyroid muscles. Mattress sutures are placed to include any large veins on the surface of the muscles, and to give added strength to the closure.

placed an inch below the insertion of the sternothyroid muscles on the thyroid cartilage. This leaves enough of the sternothyroid to be lifted cleanly from the surface of the upper thyroid pole without tearing it from the thyroid cartilage. Furthermore, this longer piece of muscle is more satisfactory for holding mattress sutures when

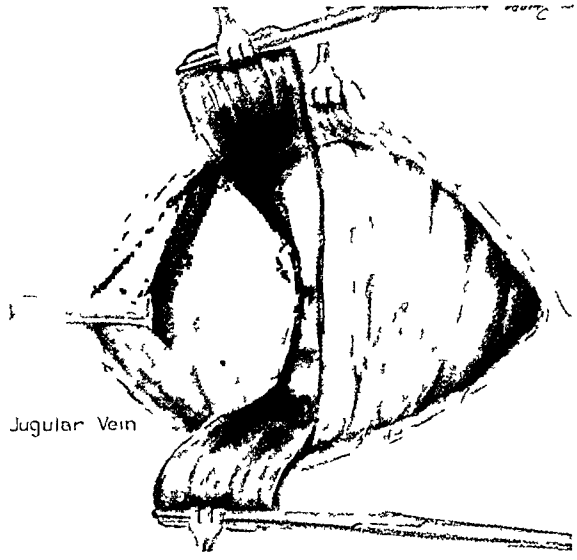


FIG 3 Using the lateral areas of the prethyroid muscles to fill the cavity left by removing part of the thyroid gland.

the wound is closed than a short frayed end.

The lateral uncut borders of the prethyroid muscles, furthermore, are very useful to pull in to the midline and to fold over the raw surface of the thyroid remnants. (Fig. 3.) This controls any bleeding and fills up the dead spaces left by the thyroidectomy. The belly of the omohyoid muscle is also preserved to fill the lateral gap left by the incision in the sternohyoid muscle, when the muscles are not cut so far laterally that it is divided. (Fig. 4.)

The slight additional time necessary to cut the prethyroid muscles and later to sew them, is well compensated by the increased ease and rapidity of completing the thyroidectomy under full vision of the gland. By using very fine chromic catgut for the mattress sutures in the prethyroid muscles and very fine plain catgut for bleeding vessels, postoperative drainage of serum is rarely troublesome.

CONCLUSION

Cutting the prethyroid muscles with careful preservation of their nerve supply gives adequate exposure in thyroid operations and produces no ill effects on the end results.

FUNCTIONS OF MEDIOTARSAL JOINT*

THEIR DISTURBANCE A CAUSE OF FLATFOOT

JOHN JOSEPH NUTT, M.D., F.A.C.S.

Orthopedic Surgeon to the Polyclinic, Willard Parker, Nyack and Long Beach Hospitals

NEW YORK CITY

THE mediotarsal joint is composed of two parts, the astragaloscaphoid and the calcaneocuboid, and divides the hindfoot from the forefoot. The chief motion is about a vertical axis and is in the direction of abduction and adduction. This vertical axis is not stationary; perpendiculars erected from tangents to the big toe, with the foot in various degrees of abduction and adduction, show it to be movable.

In extreme adduction there is an added movement in the direction of flexion at the mediotarsal and inversion at the subastragaloid. In extreme abduction there is an added movement in the direction of extension at the mediotarsal and eversion at the subastragaloid. There is also movement of the foot as a whole in the direction of adduction which takes place about a vertical axis through the joint of the astragalus with the internal malleolus. Flexion and extension at the mediotarsal takes place through a transverse axis. The latter is very limited and is accompanied by eversion. Movement in the direction of inversion and eversion occurs about a longitudinal axis passing through the subastragaloid joint. The movement is chiefly in the astragaloscaphoid and the subastragaloid joints.

If the forefoot is immobilized, as it is when bearing weight, and the ankle flexed by raising on tip toe, it will be seen that the heel is to the outer side of its normal perpendicular; that it is inverted through the longitudinal axis and that there is flexion and adduction at the mediotarsal joint. If this relationship between the forefoot and the hindfoot is preserved and the foot dorsal flexed at the ankle, the forefoot will show marked adduction; the foot will be toeing in. When toeing in, the foot is not in a normal position unless there is plantar flexion at the ankle and plantar flexion and adduction at the mediotarsal joint. Therefore a low heeled shoe should have a straight inner edge and a high heeled shoe should have the sole turned inward. If one rises on tiptoe while the toes are turned outward, there is little or no movement at the mediotarsal joint.

In flexion at the mediotarsal, with its accompanying adduction and inversion, the foot is shortened. That is why a high heeled shoe, which provides for extreme flexion at the mediotarsal, is shorter than a low heeled shoe. There are, however, high heeled shoes which do not provide for mediotarsal flexion, having flexion only at the ankle. These do not shorten the foot, the arch not being raised, and consequently force the wearer to toe out; to abduct, evert and extend at the mediotarsal joint.

Figure 1 shows diagrammatically the difficulty in attempting to walk with the toes pointing straight ahead without a functionating mediotarsal joint. The arc of movement through which the body weight must be raised is decreased by flexion at the mediotarsal.

If dorsal flexion at the ankle is limited, so that movement of the tibia on the astragalus is halted before the heel is raised, one of two things happens: (1) If halted at 90°, callosities from undue pressure form under the head of each of the five metatarsals. This condition is pathognomonic of a shortened heel cord and is a prolific cause of the various forms of metartarsalgia. (2) If the limitation of

* Read at the Annual Meeting of the Academy of Orthopedic Surgeons, Jan. 1935, New York City.

dorsal flexion is greater than 90°, it is necessary to toe out, thus shortening the lever arm. Although the distance between the

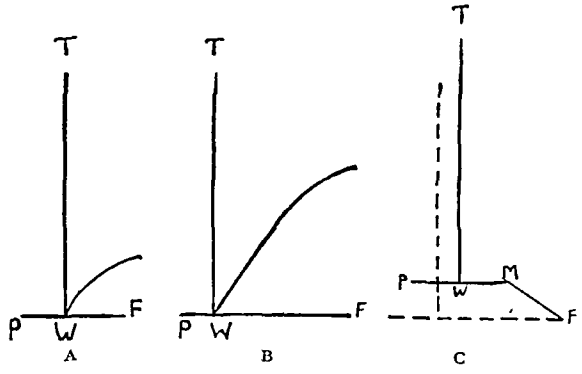


FIG. 1. T-W, tibia; P, attachment of tendon Achilles; F, metatarsal-phalangeal joints; M, mediotarsal joint. The foot-pounds of energy expended in raising W about F are decreased when the radius of curvature (W-F) is decreased by flexion at M. A and B illustrate the difference in the radius of curvature in a short foot and a long foot. In C the radius W-F is shortened by flexion at the mediotarsal.

fulcrum (the matatarsophalangeal joints) and the heel is the same or greater, by abduction at the mediotarsal and external rotation of the leg, this fulcrum is brought back nearer the transverse plane containing the center of gravity, thus shortening the lever arm, as movement is still directly ahead. (Fig. 2.)

The A-P plane containing the center of gravity should fall over the forefoot in which position it will be well supported. In abduction of the forefoot and external rotation at the hip the A-P plane of gravity is poorly supported and the superincumbent weight is a constant force acting to still further abduct, evert and extend the mediotarsal joint. This force is increased as the flat-foot walker pushes himself along with the inner side of the foot. This causes pressure of the foot against the lateral side of the shoe and results in callosities on the dorsal surfaces of the first interphalangeal joints of the two outer toes and on the lateral side of the fifth metatarsophalangeal joint. The greater part of the pressure which is normally distributed over the plantar surface of the forefoot is shifted, by eversion, to the region of the first metatarsophalangeal joint and is a cause not only of calluses under the joint but of deformities of the joint itself. The shoe will show wrinkles or folds, usually two or three,

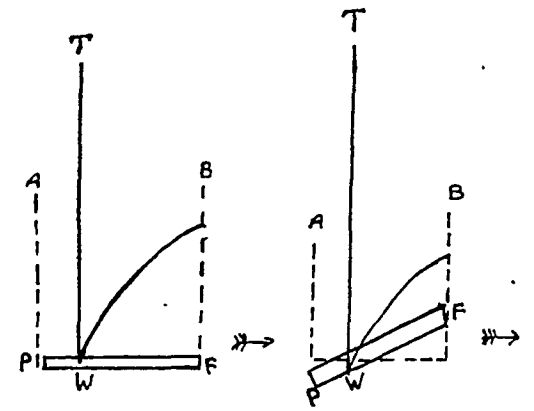


FIG. 2. When the foot (P-F) is turned outward, the vertical planes containing P and F (A-P and B-F) approach each other. With movement continuing in the same direction, the lever arms will be shortened and the fulcrum will be thrown off the line of motion. Thus the weight will be raised through a smaller arc.

in the leather mesial to the first metatarsal, from the strain in abduction and dorsal flexion. The sole of the shoe will show greater wear on the mesial side than on the lateral side. The back of the heel will show greater wear on the lateral side from striking the ground with the toes turned outward. The shank of the shoe, unless it is very stout or reinforced, will curve downward, pressed into this position by abduction and dorsal flexion at the mediotarsal joint.

Thus we see that for grace, precision, alertness and strength in the use of the foot a normal mediotarsal joint is necessary. The athlete and the dancer use this joint. It is for walking alone that we have adopted footwear which immobilizes the mediotarsal joint. Sometimes the joint is immobilized by the shoe in one of its normal positions but it can not fully functionate. As it matters little how the foot is clothed when not in use, we see many people with excellent feet who wear immobilizing shoes part of the time. This is because they wear proper footwear when exercising. When they play tennis or handball or run or dance they wear shoes which do not immobilize, and arch support-

ing shoes only when the feet are mostly inactive.

One of two things must be done to relieve the strain and pain arising from loss of function of the mediotarsal joint. Either the support which is lost by the abduction of the forefeet must be provided by extraneous methods (steel shanks or arch supporters) or the mediotarsal joint must be restored to its normal function. The provision of a shoe permitting normal movements at the mediotarsal will not of itself restore these movements. Many have expected such a shoe to cure their condition, only to find their feet much worse after its use. The foot must be prepared for the resumption of its normal functions; shortened muscles must be lengthened, weak muscles strengthened and joint and muscle sense educated. Adhesive plaster is an excellent educator. It should be applied not to immobilize but to restrain abduction at the mediotarsal and eversion of the heel.

As the first metatarsal is lowered at the mediotarsal in abduction and extension, a wedge reaching from the shoe to the ground under the first metatarsal, is an excellent aid. (Fig. 3.) Its lower surface is exactly in the horizontal plane upon which rest the sole and heel. Its presence will be felt by the wearer only when he attempts to abduct the forefoot. No wedge on the inner side of the sole is necessary. The inner side of the heel is wedged at the anterior corner, to tilt up the heel in flexion and inversion. This wedge may be ⅛, 1/6 or ¼ inch at its thickest part, depending upon the degree of eversion present.

The objection to high heels rests on their tendency to immobilize the mediotarsal joint, with the resultant loss of spring or elasticity of step, and the necessity of walking on the heels which, with each step causes a shock to the nervous system, not to speak of the wasted muscular efforts.

These nervous shocks may be very slight and yet, from their repetition at each step, may have a far reaching effect. This point is illustrated by the man with a severe

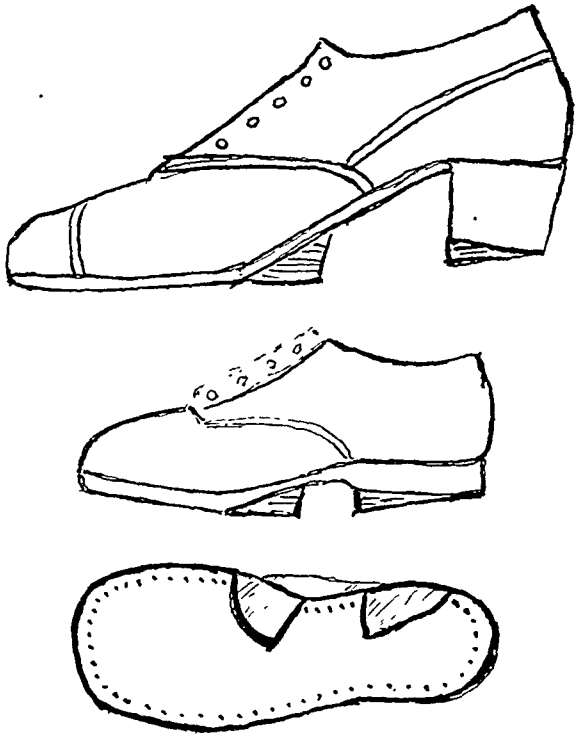


Fig. 3.

headache who unconsciously protects his nervous system from this series of shocks by walking, or teetering along, on his toes.

SUMMARY

Loss of the normal function of the mediotarsal joint is, I believe, the most frequent cause of foot complaints. This loss of function is due in great part to the use of footwear which obstructs the normal range of motions at the mediotarsal joint.

Restoration of full use of the mediotarsal joint must be accompanied by lengthening of muscles when shortened, strengthening when weakened and re-education when vicious habits have been formed. The traction shoe, adhesive plaster and an original metatarsal shoe wedge are suggested as useful methods to this end.

SUBSTERNAL THYROID*

ROBERT F. SHARER, M.D.

Guthrie Clinic, Robert Packer Hospital

SAYRE, PENNA.

IN spite of the voluminous literature which has accumulated relative to the thyroid gland, only a small portion is devoted to substernal goiters and limited in the main to reports of a few large series and isolated case histories.

It is purposed to present an analysis of 212 cases of substernal goiter which were operated in the Guthrie Clinic from 1910 to 1934. This group of substernal goiters includes all thyroid glands the lower border of which on swallowing, remained definitely below the suprasternal notch. The dividing line between substernal and intrathoracic is so difficult to establish in reviewing old histories that the latter term will not be used. Suffice to say that 8 of the 212 cases, or 4 per cent, rested upon or reached below the aortic arch.

HISTORY

Curtis[1] in a survey of the early literature found Albrecht von Haller, an anatomist at Goettingen, to have observed an intrathoracic goiter in a cadaver in 1749, while in 1826 Dubourg reported a clinical case of strangulation found at autopsy to be the result of similar pathology. Curtis[1] also noted Adelman to have recognized a malignant intrathoracic goiter in 1828 and in 1851, Bonnet to have described compression and deviation of the trachea resulting from pressure. Wuhrmann in 1896 is credited[1,2] with reporting 91 cases and summarizing the literature.

Following the advent of the roentgen ray in 1895 the accurate diagnosis of intrathoracic extensions of the thyroid gland was made possible.

ANATOMICAL CONSIDERATIONS

The thyroid gland according to Morris[3] is surrounded by a connective tissue sheath derived from the deep cervical fascia. The latter, arising from the lateral vertebral processes, gives off a layer, the transverse aponeurosis of the neck, which passing medially separates into two layers to form the carotid sheath. Medial to the sheath these layers do not unite, the posterior one passing behind the pharynx while the anterior pretracheal layer divides to enclose the thyroid to which it is loosely attached. The gland is suspended in this sheath by three or four ligaments from the laryngeal and tracheal cartilages.

The middle cervical fascia encloses the strap muscles and in common with them is attached to the manubrium and clavicles. The space between the deep and middle cervical fascias thus allows easy access into the mediastinum.

Behind the thyroid lobes lie the common carotid arteries, the left descending beside the trachea to the aortic arch; the right descending to its origin from the innominate artery. Lateral to these arteries though in the same sheath, along the lateral border of the thyroid lobes, lie the internal jugular veins. The left unites behind the clavicle with the left subclavian to form the left innominate which in turn passes behind the manubrium to join the short right innominate thus forming the superior vena cava.

The vagus nerve descending in the carotid sheath, and the phrenic lying upon the anterior scalenus muscle, pass into the thorax anterior to the arterial

* Submitted to the Graduate Faculty of the University of Pennsylvania as part fulfillment of the requirements for the degree of Master of Science in Surgery.

trunks but posterior to the venous. The vagus is more medial and gives off the recurrent laryngeal nerves.

The thoracic duct passes anteriorly over the dome of the left lung to join the left subclavian vein. The accessory hemiazygos vein unites through the superior intercostal vein with the left innominate while the azygos vein enters the superior vena cava. The symptoms of substernal thyroid result largely from pressure upon these structures.

ETIOLOGICAL FACTORS

Lahey[4] states that in 4363 exophthalmic goiters not one was substernal, while in 5131 adenomatous goiters 21 per cent extended into the mediastinum. Occasionally diffuse colloid goiters may be partly substernal later becoming nodular. A nodule in one of the lower poles is elevated innumerable times by swallowing against the resistance of the strap muscles, collars, and gravity, hence a tendency toward lengthening its supports and a descent of the nodule. It slips into the mediastinum, between the middle and deep cervical fascia. Once past the superior thoracic aperture the enlarging thorax allows easy progress while enlargement of the adenoma through hemorrhage may prevent its return into the neck.

The connection with the parent gland may become merely a fibrous cord thus forming the false aberrant thyroid lobe. Lahey[4] does not believe excessive descent of the thyroid in fetal life is a factor. Felberbaum and Finesilver[5] suggest that the descent of the thymus or heart in the fetus may draw thyroid tissue into the thorax.

Pemberton[6] believes that most so called aberrant substernal thyroids have some connection with the parent gland. However, thyroid tissue has been found in the larynx, trachea, bones, pleura, pericardium, and ovaries according to Lazarus and Rosenthal[7] and is probably responsible for an occasional rare case of substernal goiter. Terry[8] states that in the Pathological Institute of Berne there is a congenital goiter filling most of the thorax.

In one case of this series the connection above the substernal mass was so slender it was nearly overlooked. In a second case a small adenomatous mass lay posterior to the right carotid sheath behind the transverse aponeurosis in the posterior mediastinum, and was regarded to be possible aberrant origin. Pemberton[6] reported a similar retrofascial mass with a pedicle, however, attached to the isthmus, and suggested that a small nodule may have penetrated a vascular channel in the fascia.

Lahey[4] reports an average age of fifty in 1086 cases, Pemberton[9] forty-six, and Curtis[1] forty-nine years. The youngest was eighteen years of age and the oldest seventy-two, 36 per cent being in the fourth decade. The average age in the group at this Clinic has slowly risen from a five year average of forty-two years preceding 1916 to fifty-three prior to 1935, the average for the 212 cases being 46.8 years.

The incidence of substernal goiter at this clinic was .33 per cent of all surgical admissions and 6 per cent of thyroidectomies, .3 per cent of these reaching the aorta or below. These figures are low, Jackson[10] in 4006 thyroidectomies at the Mayo clinic reporting 13.5 per cent substernal and .6 per cent intrathoracic. Higgins[11] found 10 per cent substernal and 1 to 2 per cent intrathoracic and quotes Czermak's figures of 32 per cent substernal in 1473 cases.

The sex distribution here was 89 per cent females comparable to that of adenomatous goiter in general.

SYMPTOMS

The symptoms may be interpreted in the light of toxicity and pressure. Since 1920, 70 per cent in our series have been toxic, the average basal metabolic rate being plus 29 per cent and also showing a gradual rise, the average since 1930 being

plus 33 per cent. The normal range of plus 10 to minus 10 was maintained by 26.5 per cent while 3.5 per cent averaged minus 20 per cent. These figures are the reverse of Lahey's[4] who reports 70 per cent nontoxic, as does Jackson.[10] Higgins,[11] however, reports nervousness and tachycardia in over 50 per cent, the average basal metabolic rate being plus 32. The toxic symptoms in our series in the majority of cases were associated with pressure symptoms, the two being of comparative recent origin.

Since 1920, 97 patients with a history of goiter for an average time of seventeen years were treated, only 2 having no obvious enlargement. Among the 212 were 8 recurrences operated nine to twenty years ago, all returning with symptoms of pressure and toxicity, giving roentgen ray evidence of substernal thyroid.

Pressure symptoms were also present in 70 per cent, the commonest being that of tracheal compression and irritation, namely dyspnea on exertion, a "hacking" cough, and choking. Lahey[4] has well described the choking attacks occurring at night caused by plugs of mucus below the tracheal constriction and relieved by coughing out the offending substance; also the inability of the patient to lie on the side which stretches the trachea over the mass.

Choking occurs generally on bending forward or at times on raising the arms above the head and poor posture was assumed by a number of our patients as a defense mechanism against this distressing symptom. The head is held partly bent forward, this being the position of least traction on the substernal adenoma and least pressure on the adenomatous tissue above it. The plunging adenoma, or one which is movable in the mediastinum and appears in the neck at intervals, was not seen. Such goiters cause severe intermittent attacks of choking which may terminate fatally.

Dysphagia is not common but is more frequent in left sided goiters, attributed by Lamson[12] to the fact that the esophagus curves to the left. Pulsion diverticula of the esophagus may be augmented by the pressure of a substernal goiter as in the cases of Bouvier and Haberer quoted by Curtis.[1]

Pressure on the recurrent nerve leads to the symptom of inspiratory stridor apparent perhaps only on deep inspiration. Dyspnea on exertion is often present but the speaking voice is usually unimpaired. Hubert[13] reported a case of substernal goiter with fixation of the left cord in the midline and partial abductor paralysis of the right with stridor and dyspnea but only slight hoarseness. Such bilateral paralysis from goiter is rare unless malignancy is present. Hoarseness is more often the result of irritation of the larynx and trachea than to nerve injury. In this series 11 per cent suffered from hoarseness of whom only 46 per cent had cord changes.

Pressure on the innominate veins may cause dilatation of the cerebral veins which, according to Pilcher and Overholt,[14] results in vertigo, headache, lethargy, fullness in the ears, and dryness and edema of the skin. The venous pressure may be elevated in one arm or both, with relief of all symptoms following thyroidectomy. Insufficient filling of the heart provides an extra burden to the myocardium. Cyanosis of the head and shoulders may appear on bending forward, and from long standing pressure the veins about the base of the neck and upper thorax become dilated and tortuous, first as varicosities and later as collateral circulation. Schwyzer[15] described a case of hydrothorax resulting from pressure on the azygos system.

Very unusual is the case of Schultze quoted by Curtis[1] in which pressure upon the thoracic duct led to a chylothorax.

Unilateral phrenic paralysis with elevation of half the diaphragm was noted by Bachford,[16] and shifting of the heart with decompensation. Higgins[11] lists 2 cases of unequal pupils from pressure on the sympathetic system, while involvement of the vagus may lead to tachycardia.

It is thus seen that the symptoms may be analyzed from the standpoint of the structures involved. An astonishing fact is the size of the tumor to which the mediastinum can accommodate itself without severe pressure symptoms.

DIAGNOSIS

In the presence of any of the foregoing symptoms of pressure, in the fourth or fifth decade of life in whom a nodular thyroid gland is present the lower limits of which the finger can not outline, substernal goiter must be proved absent.

There is usually a long history of goiter with a recent onset of coughing or choking attacks at night, hoarseness and dyspnea on exertion. Toxic symptoms may be present.

On examination a nodular thyroid extending below the sternum may be found which moves but little on swallowing, often associated with deviation or torsion of the trachea and dilated veins over the upper thorax. In the absence of a cervical goiter on swallowing one may feel the rise of a substernal mass in the suprasternal notch. Few believe percussion is of value but it may give suggestive dullness.

Rankin[17] lists four signs of carcinoma all of which were present in the one case in this series: (1) Goiter present many years; (2) Recent increase in size; (3) Hoarseness, cough, dyspnea, cyanosis; (4) Paralysis of one or both cords. He also quotes Pemberton's figure of 2.7 per cent carcinomas in colloid and adenomatous goiters, the majority unsuspected, and Boarings 1.53 per cent in 11,100 supposedly benign adenomas. There was .43 per cent in this series.

Asthma and chronic emphysema may be simulated very closely, and if without a palpable goiter or toxic symptoms, the roentgen ray may reveal the offending tumor in the thorax. Angina pectoris may at times be confusing but the electrocardiogram and the roentgenogram should insure the proper diagnosis.

Although the roentgenogram is of the greatest value, large substernal extensions may be overlooked. Higgins[11] advises anterioposterior and oblique views with stereoscopic and fluoroscopic study of all mediastinal masses. While an aortic aneurysm is characterized by a positive Wassermann, expansile pulsation, and a constant angle with the aorta on breathing and swallowing, a substernal thyroid will change its angle with the aorta (Maclean[2]). The former is more common in men and the latter in women.

The thymus rarely causes pressure symptoms in adults and its roentgenologic outline is more hazy.

Dermoid cysts may give extensive pressure symptoms, eventually ulcerating into a bronchus with the expectoration of hair (Maclean[2]). They are not elevated by swallowing and have no connection with the cervical region. Fluoroscopically they are dense and smooth and symptoms frequently appear soon after puberty (Wessler-Jaches[18]).

Diverticula of the esophagus may be differentiated by the relation of symptoms to meals and the swallowing of barium.

Hodgkin's disease, tuberculosis and the leukemias are characterized by fixed glandular masses about the hilus of the lung and frequently external glands are available for biopsy. Blood studies are important.

PATHOLOGY

Approximately 90 per cent of the removed thyroid tissue in this series was diagnosed as colloid adenoma, usually multiple, with cystic changes in 15 per cent, calcification in 12 per cent, and hemorrhage in 10 per cent. Hyperplasia was reported in 2 cases or about 1 per cent, the remaining 9 per cent being diffuse colloid goiters. Higgins reports 3 cases with hyperplasia but Lahey[4] has never seen a case of true exophthalmic goiter develop substernally.

Carcinoma was present in one case of our series or .43 per cent.

The substernal mass was on the left side in 76 cases, on the right in 40, bilateral in 32 and reported merely as substernal in 36 cases. In 2 cases large cysts were adherent to the aorta, one of which contained pus like material within friable walls. Curtis[1] states arteriosclerosis and hyaline changes in the vessels are common, resulting in hemorrhage and cyst formation, and with Delaney[19] has reported a case of cavernous hemangiectasia within a nodular goiter.

TREATMENT

Irradiation therapy for thyrotoxicosis is shown in a favorable light by Pfahler,[20] Davies,[21] and Stevens,[22] but the substernal adenomatous mass causing pressure and at times toxic symptoms, prone to hemorrhage, calcification, and cyst formation, is generally considered a surgical problem.

The preoperative care of thyroid patients in the Guthrie clinic has been reported in detail by Guthrie and Conklin.[23] A modified anoci-association technique is used, the patient believing he is to have a basal metabolic rate taken. Sodium amytal in doses of 6 to 9 gr. is given two hours before operation. At times a basal dose of avertin is given thirty minutes preoperatively instead of the sodium amytal. Morphine gr. 1/6 and atropin gr. 1/100 are included and ethylene given as needed.

Lahey[4] and Young[24] strongly advise an intratracheal catheter in substernal cases to insure a free air passage. Colp[25] reported a case with severe pressure symptoms which he safely removed with a 17 mm. bronchoscope in the trachea.

The superior polar attack is employed in this clinic, the branches of the superior thyroid artery being clamped and cut individually as they run over the upper pole, carefully excluding the muscle tissue. The upper pole is easily rolled down and the lobe separated from the trachea leaving a strip of gland over the recurrent laryngeal nerve and the parathyroid bodies. Over the upper tracheal rings where the gland is most adherent the nerve may lie within the substance of the lobe, hence the need of leaving a thin layer of thyroid tissue. Guthrie[26] has emphasized the importance of wide exposure and the removal of all hemostats before attempting to elevate the substernal portion, and has described[27] an everchanging attack upon the gland compatible with quiet respiration which avoids traction injury to the nerves. Any adventitious sound may be charged to operative trauma and not to the ethylene anesthetic.

The finger is passed into the mediastinum between the lobe and the carotid sheath and the mass explored and gently freed from its capsule. The finger is then removed and using the lobe as a tractor, an attempt is made to elevate the substernal portion the anesthetist being prepared to furnish oxygen under pressure if tracheal embarrassment arises.

In some cases the finger or a silver spoon (Lamson[12]) must be used below the gland. In one case of this series it was necessary to aspirate a cyst prior to its removal while in a second the friable walls of a cyst were so adherent to the aorta that a portion was allowed to remain. Care must be exercised to avoid overlooking a second projection, as in 8 cases one lobe occupied a portion of the anterior mediastinum and the opposite lobe the posterior. Morcellation may be necessary at times but is undesirable. Notching or splitting of the sternum was not required in any case.

After delivery of the mass the vessels at the lower pole are clamped and cut as they branch up on the gland thus protecting the nerve where it lies in close association with the inferior artery. Further protection to the nerve is obtained by clamping and tying the inferior thyroid vessels in the long axis of the neck. The internal jugular vein was injured in 2 cases as it may be elevated far above its normal position through elevation of the lobe; no ill effects followed isolation, section, and ligation of the vein in either case.

Lahey[4] packs the cavity for one week as a precaution against mediastinitis, the packs then being replaced by rubber tissue. In this clinic rubber tubes are placed in the cavity to be removed in three to five days, after which rapid obliteration of the cavity occurs through the lung resuming its original domain. Maclean[2] ligates the bleeding points in the cavity and stitches the ligatures into the sternocleidomastoid muscle thus elevating the floor of the space.

In this series no mediastinitis, rupture of the pleura or herniation developed. Shifting of the deviated trachea toward its normal position was observed but tracheal collapse was not encountered.

Postoperatively, avertin insures the patient a quiet period when restlessness and coughing greatly increase the danger of secondary hemorrhage. Laryngeal examinations should be made at intervals. Roentgenograms will show gradual obliteration of the old tumor cavity and the return of the trachea to the midline. Cattell[28] found the trachea to return to the midline within three months and to regain its normal size and shape. The so called tracheal collapse he believes is due to hemorrhage or nerve injury.

COMPLICATIONS AND MORTALITY

Among the 212 cases were 6 deaths, a mortality of 2.8 per cent as compared with 1.1 per cent for all thyroidectomies in the past ten years. Lahey[4] reports a mortality of 2 per cent but only 30 per cent of his cases were toxic. The 6 cases ending fatally were all large substernal goiters, all mildly toxic, with an average age of fifty years.

Deaths	Time	Cause of Death
1	6 hours	Cardiac dilatation
1	20 hours	Myocardial failure
1	20 hours	Myocardial failure
1	8 hours	? Cyanosis dyspnea Tracheotomy failed
1	15 days	Multiple hemorrhages
1	4 days	Pneumonia

Three deaths were the result of cardiac collapse. Severe myocardial damage was present in all three patients but the severity of the symptoms demanded surgical relief. It is difficult to estimate the burden thrown upon the heart by the removal of an intrathoracic mass.

Massive hemorrhage is a serious complication not so much from loss of blood as from the possibility of suffocation, the shock of opening the wound, and the danger of injury to the parathyroid bodies. The first interne to attend such a patient should be authorized to open the incision at once. In the operative technique, the vessels must be caught accurately before dividing, thus preventing their retraction, and when tied firmly with silk they may be considered secure. Mass ligatures must be avoided and the muscle excluded.

One of the reported fatalities was the result of repeated hemorrhages in a sloughing bed. A second case was returned to the operating room and the bleeding vessel secured with recovery.

Tracheotomy was performed on the one patient in the presence of cyanosis and dyspnea without success. A saber trachea was present before operation, the result of bilateral substernal adenomas with paralysis of the left cord. No hemorrhage was present. It must be remembered in cases of low tracheal obstruction an unusually long tracheotomy tube is required.

Following operation the patient is placed in a semireclining position, drafts are avoided, steam or compound tincture of benzoin inhalations given as required, and sips of warm soda water provided. Carbon dioxide inhalations are carried out at the first sign of atelectasis. In spite of these measures one death resulted from pneumonia.

In most cases the larynx was examined before and after operation. No case of

preoperative cord paralysis was improved but several cases with marked lagging became negative following surgery.

Following operation the left cord was involved twice as often as the right, explained perhaps by the higher incidence of the tumor on the left. Lagging of the cords was symptomless and transient. Unilateral fixation in the midposition was accompanied with only slight inspiratory stridor in a few instances and with no change in the speaking voice. A number recovered later. Two cases of bilateral fixation in the midline were not severely handicapped, one breathing and talking easily but snoring when asleep.

Paralysis following thyroidectomy may consist in fixation of the cord in the midline, i.e., paralysis of the abductors with preservation of adduction. The function of abduction in the recurrent laryngeal nerve is much less resistant to injury than that of adduction, and it is possible that many such palsies are the result of stretching or pressure on the nerve. Lemere[29] states that even after complete section of the recurrent nerve the cricothyroid muscle enervated by the external ramus of the superior laryngeal nerve still tenses and slightly adducts the cord. Freedman[30] reports 7 such abductor palsies with normal speaking voices.

Section of the external ramus of the superior laryngeal nerve relaxes the cord causing slight difficulty with phonation but no dyspnea. Section of both nerves on one side results in a cadaveric position rarely seen in thyroid surgery.

Bilateral recurrent nerve injury brings the cords together in the midline with inability to abduct hence inspiratory stridor is often severe but at times with a good speaking voice.

Tetany was not encountered. Ligation of the three branches of the superior thyroid artery on the surface of the gland preserves any separate branches to the parathyroid bodies. Dramatic results may be obtained with parathormone and calcium in the acute case of tetany and the high calcium low phosphorus diet has been used in this clinic with marked success in the chronic type.

CONCLUSIONS

The recognition and safe treatment of substernal goiters has been largely evolved since the discovery of the roentgen ray. Substernal goiters develop in most cases from adenomatous thyroid tissue. This development may be explained on a mechanical basis.

The adenomas may project into the anterior or posterior mediastinum or both, and are at times behind the transverse aponeurosis.

It is a disease of long standing, middle age, largely confined to females, and is not uncommon where goiter is endemic. Toxicity is present in from 30 to 70 per cent of cases.

The treatment is surgical removal; all nodular goiters which extend below the sternum should be explored, regardless of symptoms.

An operative technique is described which safeguards the nerves from direct injury and from traction, protects the parathyroids and their blood supply, and makes possible the delivery of the substernal mass.

Early removal of the drainage tubes allow a collapse of the cavity without danger to the mediastinum.

An analysis of the causes of death following surgery clearly indicates the need for earlier treatment.

Tetany may almost be eliminated with careful technique.

Lagging of the cords before operation may disappear after thyroidectomy.

Laryngeal involvement postoperatively in most cases is the result of traction or pressure from tissue swelling and the majority will recover.

Permanent abductor paralysis of one cord is not attended usually with serious difficulties.

[*For Remainder of References see p. 99.*]

EVISCERATION AND AVULSION OF ABDOMINAL WOUNDS*

S. THOMAS GLASSER, M.D.

Instructor in Surgery and Assistant Attending Surgeon at Metropolitan Hospital and Flower-Fifth Avenue Hospital

NEW YORK CITY

ONLY in recent literature is any comprehensive reference made to the subject of evisceration, the discussions coming under the synonymous headings of eventration, evisceration, dehiscence, avulsion and rupture of abdominal wounds. Many theories have been advanced concerning the evolution of this condition, but the etiology of evisceration is not as mysterious as many would have us believe. The solution of any problem is extremely difficult or improbable when information pertaining to the evolution of the pathogenic processes is not available. Eventration has never been experimentally reproduced nor has anyone traced the developmental stages of this complication. However, we have arrived at the conviction that evisceration is primarily the end result of increased intra-abdominal pressure, while the great number of other factors generally enumerated are secondary.

During the past ten years the combined surgical staffs of the Metropolitan Hospital have performed 3234 laparotomies. Of this number, only 8 cases, or 0.24 per cent, of eventration were present with a mortality of 75 per cent. Similar methods of abdominal closure were employed throughout, that is, closure by layers with plain catgut for the peritoneum, chromic catgut for the fascia and non-absorbable suture for the skin. For the past few years Dr. Fobes and his staff have reenforced the fascial layers with ox fascia in those cases where a weak abdominal wall or other similar conditions suggested its prophylactic use.

DEFINITION

Evisceration, eventration, prolapse of intestines, dehiscence, rupture, disruption, avulsion, separation of abdominal wounds, all these concern the giving way of the incision. The first three terms include the protrusion of viscera or disembowelment, the others refer to a splitting or breaking of the wound. This terminology is often misconstrued and must not be considered synonymous. With this in mind we have included expressions of both conditions in the title of this paper.

ETIOLOGY

Our personal experience and a review of the literature would lead us to the conclusion that the accident of evisceration or avulsion of abdominal wounds is primarily due to increased intra-abdominal pressure. Except from the viewpoint of prophylaxis, all other factors such as careless technic in suturing, systemic disease, infection, etc., play only a secondary role in the causation of the accident. For completeness, we will first discuss the secondary factors preliminary to the exposition of our contention that increased intra-abdominal pressure is of greatest etiological importance.

Age: At first glance, age would appear significant because the incidence of disruption is statistically greater between the third and fifth decades. However the accident has been noted in every period of life and since the greater number of operations occur between thirty to fifty years, interpretation of figures is misleading.

* From the service of Dr. J. H. Fobes, Director of Surgery, Metropolitan Hospital, New York City.

Sex: Sokolov,[26] Meleney and Howes,[6] and others have placed the incidence of occurrences in the ratio of two males to one female. The majority of writers however agree that there is no sex relationship. In our small series of 8 cases, there were six males and two females, a ratio of three to one.

Season: Seasonal relationship is mentioned only by Sokolov,[26] who contends that the avulsions are present chiefly in the winter and spring seasons. This data was derived from cases occurring in the locality of northern Europe. He attributes this to the lack of fresh vegetables in the diet during these seasons, resulting in a condition similar to scurvy, interfering with tissue healing.

Infection and Drainage: There is much controversy concerning the relationship of infection and drainage to dehiscence. Infection causes an early absorption of catgut and is also responsible for the slipping of knots. However the percentage of wound disruptions in infected cases is not sufficiently high to warrant placing it as a prominent etiological factor. In Colp's[5] series, the incidence of dehiscence in drained cases was 1.22 per cent as compared with 0.84 per cent in undrained cases. Drainage is best obtained through a stab wound removed far from the incision, thereby diverting the drainage tract from a field which may heal by primary union with less likelihood of postoperative hernia formation. In Cave's[7] series of 444 cases he noted that in 282 operations without drainage there were no postoperative hernias, while in 162 drained cases, 21, or 12.9 per cent, hernias were present.

Type of Operation: Eventration has occurred most frequently following operations for gall bladder and gastric disease, malignancy and uterine fibroids. It should be kept in mind that these cases are commonly followed by complications such as emesis, distention, pneumonia, etc. The significance of this will be discussed later. The operations mentioned are those in which there is more than the ordinary amount of trauma and manipulation. The time factor has not been regarded as being important etiologically. However, trauma to the viscera or a shocking procedure must be considered.

Systemic Disease: It has become an accepted dictum that wounds heal slowly in the presence of systemic disease, such as syphilis, diabetes, jaundice, cancer, in the aged and the debilitated. However, it is also a fact that when dehiscence does occur following the primary operation, even in the presence of systemic disease the wound heals remarkably well when resutured. Why? There have been many instances of normal healing in syphilitics. It is not our purpose to dispute the fact that systemic disease may and does affect healing, but we feel that its relationship to dehiscence is not direct or of major significance.

Day of Disruption: Disruption commonly follows the removal of the sutures on the seventh or eighth day. The following table illustrates the experience of several surgeons.

Meleney and Howes[6]	seventh to tenth day,
White[8]	eighth to tenth day,
Colp[5]	second to eleventh day (seventh most common),
Lahey[9]	seventh to twelfth day,
Starr and Nason[13]	usually eighth day.

In our series of 8 cases, evisceration occurred on the fifth, sixth, eight (3 cases), ninth, eleventh and twelfth postoperative day.

Commonest Site of Disruption:

Madelung[25]	Lower abdomen,
White[8]	Upper abdomen,
Grace[4]	Upper abdomen; 39 of 46 cases,
Horsley	65 per cent above the umbilicus in 21 cases,
Freeman[11]	Lower abdomen,
McCauliff[12]	Nearly 100 per cent above the umbillicus.
Starr and Nason[13]	Majority in lower abdomen.

The upper abdomen is the most common site of disruption. In our series, 7 were upper abdominal.

Incidence:

	No. Laparotomies	Per Cent
Colp[5]	2750	0.9
Holterman of the Marburg Frauen-Klinik	786	2
Fincke of the Marburg Frauen-klinik		1.1
Chicago Lying-in Hospital—1010 cesarean sections		0.3
McCauliff[12]		0.1
Starr and Nason[13]	2455	0.61
Kennedy[15]—Joseph Price Hospital No evisceration in 56 years		
Sokolov[26]		2 to 3
Metropolitan Hospital, New York City	3234	0.24

Type of Incision: Undoubtedly the type of incision is important in the etiology of disruptions. In considering this relationship a few anatomical facts are brought to mind. The fibers of the posterior sheath of the rectus run transversely. Many believe that this layer is the first to break under the stress of disruptive forces. In great part, the elastic fibers of the skin also run in the transverse direction and thus thin scars are seen in transverse wounds. The linea alba has a deficient blood supply and is therefore less resistant under stress. Respiratory movements exert a pull on the muscles attached to the costal angle and cause the greatest tension on vertical wounds. Disruption is by far commonest in vertical incisions. Meleney and Howes aptly state that "the position that the patient assumes or may assume after operation favors the closure of a transverse wound and favors the opening of a vertical wound. The Fowler's position in a Gatch bed relieves all tension on the wound surfaces of a transverse incision." Several investigators have commented on the etiological significance of the muscle splitting as compared to the muscle retraction operation, and the concensus of opinion favors the use of the latter method. However, opinions vary on this point. White[8] observed 30 instances of dehiscence following midline, split rectus and retracted rectus incisions but none after intermuscular, Pfannenstiel, costal or transverse incisions. Sokolov[26] collected 606 cases of disruption of which 76.4 per cent were in midline incisions. Of these, 229 cases or 57 per cent, were above the umbilicus and 167 cases or 42.18 per cent, were below. Madelung[25] had 140 midline cases with 124 disruptions below and 16 above the umbilicus. Since Madelung operated chiefly on gynecological cases, and those operated above the umbilicus were mainly poor operative risks such as in cancer and gastric resections, his findings are obviously not pertinent to the question under discussion. Colp's[5] statistics reveal an incidence of 2.2 per cent disruptions in upper right rectus incisions, 0.54 per cent in lower right rectus wounds and 1.5 per cent in paramedian hypogastric incisions. McCauliff[12] believes that incisions through the muscle are more susceptible to disruption because of injury to the nerve supply. In his questionnaire sent to numerous surgeons, he found that 75 per cent of cases occurred after midrectus incisions and 25 per cent in transrectus and midline incisions. Starr and Nason[13] noted that the muscle retracting procedure was better than the muscle splitting or midline incisions. Grace's[4] experience with the McBurney operation reveals a complete absence of disruption. This has also been Colp's[5] experience although he used this incision in only 49 cases. Sokolov,[26] who has collected the largest series of disruption cases, mentions only 2 following the McBurney incision. All of our cases of evisceration occurred following vertical incision. Another factor regarding the incision is reoperation through an old scar. Although many surgeons claim that this is not an advisable procedure, we would disagree in the condemnation of this method. Colp[5] found no disruptions following excision of the old scar.

Type of Closure: In discussing the methods of closure let us first collect our knowledge on the subject of healing in wounds and the role played by the various

suture materials. We will then discuss the relative values of the different methods of closure and the materials employed. Firor[29] states that, "The natural method for obliterating a cavity in a clean wound is by filling it with a blood clot, and in an infected one by the production of granulation tissue. A sterile blood clot quickly adheres to the adjacent tissues, contracts, and becomes organized by fibroblasts. A study of the factors aside from infection that retard the healing of wounds is important. Old age, malignancy, anemia, and diabetes are general conditions which have untoward affects upon the normal healing processes." Normally, the fibroblasts begin to proliferate and arrange the structure of the new scar tissue after forty-eight hours. We have all observed that some wounds heal quicker than others, the conditions at the start being apparently equal. Aside from hematomas, seratomas, etc., the cause for delayed healing in some cases is controversial and usually theoretical. It would be of great advantage if catgut could be standardized. Inasmuch as twenty-day or forty-day catgut is often absorbed in as quickly as four to five days, it is difficult to attribute faulty healing to sutures whose absorption and tensile strength at a given time is actually unknown. However, we do know that catgut is rapidly absorbed in a sterile exudate or pus. White[8] aptly summarized one aspect of the question by describing the situation as, "people whose tissues for an unknown reason quickly absorb catgut." It is known that healing is approximately four times as fast in serous and mucus membranes as in muscle tissue. The larger the strand of suture material, the slower the absorption, this being especially true of the knot. However the reaction with heavy suture is greater. Absorbability is apparently a part of a process of digestion and solution, in which formed tissue ferments penetrate the suture. In Meleney and Howe's[6] 63 cases of evisceration there was a complete absorption of catgut. A probable explanation of this finding is suggested in our theory which is discussed later. In their selection of suture material, some surgeons feel that catgut causes a greater reaction in the wound than silk. Cave,[7] Meleney and Howes[6] claim that silk is better than catgut for clean cases because it causes less exudation, decreases the chances for infection and does not lose its tensile strength. They forbid the use of silk in infected cases. Several operators employ interrupted sutures for fascia. It is agreed that the eversion technic is best for peritoneal closure. Fascia must be sutured to cleansed fascia without the interposition of muscle or adipose tissue. Most observers have found that silkworm gut cuts into tissues and favors stitch abscesses. This type of suture has not prevented disruptions. White[8] prefers dermol to silkworm gut because it is less brittle, has uniform tensile strength and is less irritating to the skin. Colp[5] has employed retentions in only 12 of 2750 laparotomies. He claims that retentions tend towards fat necrosis with liquefaction, deep stitch abscesses and local necrotic damage. However retentions probably do play a part in the security of the wound. Kennedy favors the sole use of through and through silkworm gut for closures. He completely avoids buried sutures of any kind. He emphasizes care in retraction, minimum traumatization of tissues and decreased exposures. His reasons for discrediting the suturing of wounds by layers are, that, "each buried suture is in a sense a ligature and is accompanied by molecular death from the crush of tissues and the suture remains for some days a foreign body. There is a great exudation incident to buried catgut and the edema from it is probably the most potent factor in tardy healing." He adds that the through and through suture does not cause molecular death and furthermore serves as a drain.

THEORIES

1. Lack of healing power: Colp[5] observed that, "The crux of the problem seemed to rest in the failure of regenerative

powers of the tissues to promote healing." This explanation is frequently offered. However it is agreed that the same wounds heal well when resutured.

2. Formation of hematomas or seratomas: This theory is suggested by Lahey.[9] Hematomas are possible factors in cases of transverse incisions where the severed ends of the recti muscles are separated and leave a well. A similar situation in the ordinary properly handled wound is unlikely.

3. Infected wounds: The fact remains that wounds left wide open often heal well. Infection is probably only a contributory factor in dehiscence.

4. Ineffectiveness of sutures: They either absorb too early, cut through, or break; but this is usually secondary to other causes, i.e. absorption of sutures in serum, improper closure, increased intra-abdominal tension, infection, etc.

5. Freeman's Theory: Freeman[11] believes the primary cause to be inadequate closure of the peritoneum whereby the omentum acts as a wedge forcing its way through the gap in the peritoneum. Healing in the wound is thereby made impossible. The omentum becomes strangulated, inflamed, enlarged, and acts as a part of an "expanding wedge." Then rupture results from a sudden strain as sneezing, coughing etc. Since the omentum is located chiefly in the center of the lower abdomen, Freeman claims that disruptions occur most frequently at this site. He states that he has always found a tongue of omentum in the ruptured wound. The accident occurs early postoperatively as is generally evidenced by such signs as tumefaction, leakage of sanguinous fluid and signs of intestinal obstruction. He concludes that secondary suture results in firm healing because there is no protusion of omentum. In his experiments on dogs, conducted by the Department of Pathology at the University of Colorado, laparotomies were performed in which a tongue of omentum was placed under the sutured fascia between the muscles. There was failure of healing in a number of the dogs. However, no evisceration occurred, although Freeman claims that with the necessary strain the accident would have happened.

6. Weber's physico-chemical theory: Weber[21] assumes that the underlying cause of rupture is an increase in the acidity of the tissues due to some form of systemic intoxication.

7. Phlebitis Theory: Ducuing[1] noticed the presence of phlebitis in 4 of 5 recent cases. He claims that phlebitis causes an edema of the abdominal wall and, that, "parietal-venous thromboses and disturbances of the sympathetic innervation, determining local disturbances of the tissular trophism opposing cicatrization and favoring the cutting through of the stitches and the opening of the knots."

8. Toxic Theory: Healing is absent or retarded and dissolution of catgut takes place in the presence of toxemia, acidosis etc. Nevertheless, healing by primary union is the rule in nearly all cases of toxemia. No difficulty is encountered on secondary suturing.

9. Interference with nerve supply: Any incision through muscle which destroys the nerve and blood supply results in a loss of the buffer action of that muscle. However true this may be, the greater percentage of split muscle operations do not disrupt.

We maintain that the underlying factor in the causation of dehiscence is increased intra-abdominal pressure.

10. *Increased intra-abdominal pressure:* Cough, hiccough, meteorism, emesis, sneezing, gagging, gastric lavage and undue postoperative activity are manifestations of increased intra-abdominal pressure. The greatest intra-abdominal pressure is definitely in the upper abdomen. Incisional hernias must be considered in the same light as dehiscence, the former being the incomplete stage of what must eventually have resulted in wound disruption. The causative factor is therefore the same in both complications. Abel's statistics from German clinics showed 8.9 per cent hernias following longitudonal incisions with heal-

ing per primam, and 31 per cent after healing per secundam. Furthermore it has been found that the great majority of incisional hernias develop early after operation, from which their presence is presumed within the first week after operation. The incidence of hernias is interesting. Stanton found 24 postoperative hernias or 4.8 per cent in 500 laparotomies, Masson at the Mayo Clinic in 5502 cases of hernias of all types noted 10.8 per cent of incisional hernias; Roosevelt Hospital 6.02 per cent of 1928 hernias and 2.2 per cent of 5366 laparotomies; Coley 1.5 per cent of 3000 hernias. We believe that these figures actually give the incidence of potential disruptions. In all probability the deep dehiscence must have occurred at an early postoperative stage within the first few days, with the true state of affairs concealed by a united skin. In our opinion there is no mystery connected with this tragedy. When case records do not reveal a history of increased intra-abdominal pressure, patient interrogation will usually disclose that the patient did not complain of a violent sneezing or coughing spell or that the intern failed to record some sign of increased intra-abdominal pressure which was present. This pressure may be marked. Every surgeon knows the great force which is required to hold back the viscera during an operation when retching or vomiting occurs with the patient only partially under the effect of the anesthetic. A rough estimation of this pressure would perhaps be fifty pounds. Horner[2] records a case of evisceration through a forced *split in the fascia about 0.5 cms. from the suture line, the sutures remaining intact.* This was preceded by a persistent cough which was the cause of the increase in intra-abdominal pressure of this great degree. In another case, Horner noted a second evisceration following violent coughing where secondary through and through sutures had been employed. Case 1 of our series eviscerated five feet of small intestine through a small drainage opening following a gastric lavage with marked gagging. The entire wound was firmly healed with the exception of the drainage opening. Since the omentum had been anchored to the stomach at the primary operation, none was present in the wound when evisceration occurred. Dehiscence is more common in upper abdominal wounds because the pressure is greater in this region of the abdomen. Disruption is usually noticed after the seventh day because at this time the skin sutures are removed thus permitting a visualization of the underlying pre-existing pathology. The high incidence of disruptions associated with systemic diseases, as malignancy, diabetes, etc., may be explained by the fact that the recuperative powers of these patients are below normal and therefore they tend to become distended or develop other postoperative complications which increase the intra-abdominal pressure. Meleney and Howes[6] reported 63 cases of disruption, 49 illustrating increased intra-abdominal pressure. It cannot be denied that other factors, as infection, poor closure, systemic disease, etc., are of importance, but these are secondary and facilitate disruption only in the presence of increased intra-abdominal pressure. We cannot overemphasize the importance of exact postoperative progress notes in this regard. In Case 1 there was no record in the progress notes which could account for the disruption. However after careful interrogation the patient admitted severe retching and cough when a gastric lavage was attempted. This was followed almost immediately by evisceration. Thus, helpful data is obtainable in great part only from the patient himself.

MORTALITY

The mortality is lowest when evisceration occurs before the fifty day. Early recognition of the accident is important for a better prognosis. General reports on mortality throughout the United States varies between 30 to 75 per cent. The causes of death are peritonitis, hemorrhage, acute gastric dilatation, postoperative pneumonia

and shock. The following mortality tabulation is significant.

McCauliff[12]	6 per cent in clean cases; 50 per cent in infected cases.
Meleney and Howes[6]	44 per cent
White[8]	53 per cent
Colp[5]	28 per cent
Madelung[25]	22 per cent
Grace[4]	41 per cent
Scherer	47 per cent
Erhardt	20 per cent

SIGNS AND SYMPTOMS

The signs and symptoms of disruption are few and manifest. Inspection of the wound may be negative or reveal only a slight fullness or the skin edges may gape. The presence of sanguinous fluid on the dressing is an important sign and should lead one to suspect the imminence of evisceration. Following some excessive strain, the patient may feel the sudden give of the wound. Pain may be present but is commonly absent. The accident may be sudden, or accompanying the preceding symptoms, a knuckle of gut or omentum is sometimes visible. Vomiting is occasionally present. Shock is usually absent but occurs at times when the evisceration is sudden or diffuse. White[8] points out that, "It is astonishing to note how quickly the final stage may occur and with what freedom from pain or discomfort." Horner[2] states that, "The commonest complaint is that of excessive moisture in the dressings. Even the binder and bed clothes may be drenched. The patient may feel the wound tear open or give way during a strain." Horner did not observe shock in his 3 cases.

PATHOLOGY

The pathology of disruption varies, depending upon how soon it occurs after operation and the degree of its progress.

Ordinarily there is a complete break through all the layers. However one occasionally sees protrusion of gut through a small opening, as in Case 1. Prolapse of the abdominal contents may be absent or the major part of the small intestine and omentum may be found on the abdominal wall and not unusually it is found adherent to the edges of the wound. Strangulation of a knuckle of gut has been also recorded. The discharge of fluid present is peritoneal transudate, unless infected and in most cases infection supervenes early. The catgut is usually found absorbed. This may be explained by the early dissolution and giving way of the suture which is bathed and digested in transudate or exudate, the peritoneal fluid. McCauliff[12] found that, "Practically all ruptures of fresh wounds show the peritoneum separated and retracted under the edge of the muscle." Immediately following the dehiscence, examination reveals bleeding only in the skin edges. White[8] clearly explains the sequence of events which supports our contention that early rupture must result from increased intra-abdominal tension when he states that, "The subcutaneous tissue long since has separated so that the disruption is completed when the silk is removed from the skin and the sole adhesive material is some new granulation tissue between the skin edges. If the deeper tissue separated at the same time as the skin edges, not only should there be fresh bleedings but the various layers would not have become adherent and overlapping with fibrinous exudate over all."

PROPHYLAXIS

Prophylaxis entails the close observance of surgical fundamentals including pre- and postoperative care, methods of suture, materials, and drainage. It is important to remember the safeguarding measures at our command in order to make the patient a better operative risk. This is sometimes difficult to attain in cases of emergency because of the time factor. The anemic individual may require whole blood transfusion; hypodermoclysis of glucosaline for toxemias, acidosis, dehydration, etc.; insulin therapy for the diabetic; building-up measures for malnutrition; kidney disease regimen; care of jaundice; etc. The fundamentals emphasized by Brandson and

Hillsman[28] are of paramount importance not only for preoperative but for postoperative care as well. They say in effect, that, transfusion restores serum protein; decreases capillary permeability and combats shock; that since 1500 c.c. of fluid supplies the normal needs of the body, the patient requires this amount plus the volume of fluid lost pathologically; that in severe trauma or prolonged handling of gut, this loss may be 35 per cent or, 1750 c.c. of the blood volume; that this also applies to preoperative vomiting, acidosis, etc. Details in technique are important in prophylaxis. Hayner[14] noted that "accumulation of blood and serum or liquid fat may hasten dissolving of catgut hence the importance of perfect hemostasis; of gentle sponging of fat . . . Excessively thick catgut invites exudation and infection." Tissue necrosis results when sutures are tied too tightly. Mattress sutures are best for the posterior sheath of the rectus muscle whose fibers run transversely. The importance of security in this fascial layer and the peritoneum is essential to sound closures. Despite the disadvantages of retention sutures previously mentioned, their value is apparent. Retentions may be through and through or only include the anterior layer of fascia. The former type entails the danger of including a piece of omentum or may cause adhesions by intraperitoneal irritation. Meleney and Howes[6] dissent in stating that if retentions only pass through the anterior layer of fascia instead of through and through, they have little effect against increased intra-abdominal pressure. The retention suture must be tied loosely and should not include too much tissue. The trend of opinion favors the removal of retention sutures on the twelfth day or even later. Baldwin[10] waits fourteen days and in so doing he claims that no eviscerations have occurred in 16,465 cases and that, "post-operative herniae are almost unknown." Prophylaxis against dehiscence, aside from the possible control of conditions which may cause increased intra-abdominal pressure, is the proper closure of the wound, proper cleansing of fascia of its areolar tissue and fat. Fascial union requires approximately twenty-one days and depends on the technic of suturing in which the important step is proper cleansing of the fascia. As a further precaution to insure firm closure, Dr. Fobes employs ox fascia grafts in cases where adverse conditions maintain, viz. weak abdominal wall, chiefly in the upper abdomen, etc.

The question of procedure in infected wounds is of great interest. Colp,[5] Horner[2] and others feel that infected wounds should be left wide open and packed with gauze. Colp advises against leaving the wound open only down to the fascia because, "the skin and subcutaneous tissues aid in the healing processes of the less vascularized fascia and the likelihood of fascial separations under adverse conditions is increased." The packing should be allowed to remain for ten days and when removed the granulations are so healthy that the skin may be approximated with adhesive. Farr's technic varies slightly. In several hundred cases of peritonitis and infection when the right rectus muscle splitting or retraction method was employed, the wounds were left wide open and packed with the Gibson-Mikulicz tampon. No sutures were used and the results were excellent. Evisceration was rare. The packing was removed on the fourth day and the rubber dam left in place. Clean and granulating wounds were nearly always present. There were no more postoperative hernias than in infected wounds treated by suture and drain. In cases of acute abdominal emergencies, Reid[3] used the following method. When any likelihood of infection was present, he employed through and through sutures of No. 20 gauge silver wire which were removed on the sixteenth to the eighteenth day. He claims that the advantages of this method of closure are security, rapidity, the abdomen can be closed under tension, the incision is easy to reopen by untwisting the wire; in peritonitis and infection drainage can occur between the sutures; the security

of closure allows the patient to get out of bed earlier; the incidence of postoperative hernia is no greater than in ordinary closures; and there has been no case of evisceration even when infection was severe. Reid's objections to the silver wire method are few: that pain is present in the incision because the wire is not as pliable as ordinary suture; there is some infection around the wire, but no greater than silkworm gut; and there is some cutting into the skin.

The choice of the type of incision is also of importance. Whenever possible one should choose the McBurney or Pfannenstiel incision since statistics reveal practically no dehiscence or hernia following their use. This further bears out the relationship of postoperative hernia to disruption. Indeed, the majority of patients with incisional hernias are unaware that they were on the borderline of evisceration soon after the primary operation!

A scultetus or snug abdominal binder is of aid in the security desired against disruptive forces. Its routine use should be advised.

TREATMENT

Treatment of disruptive is either operative or nonoperative, packing and adhesive strapping. When the patient's condition is critical and shock is present, the nonoperative procedure is preferable. This would also apply to cases with marked infection. The operative method generally employed is the placing of through and through nonabsorbable sutures. As has been previously noted, the earlier the treatment following disruption, the better is the prognosis. It is interesting to note the variations in technic among different operators. Horner[2] does not close the wound in the presence of infection. He covers the protrusion with perforated rubber dam and then applies a wet dressing. In a post cesarean with nephritic toxemia, cardiac decompensation and hypertension, under local anesthesia he covered the bowel with rubber tissue, inserted through and through sutures fixed to rubber tubing on each side. The rubber dam was gradually removed as the wound edges were drawn together. Lahey[9] believes that through and through sutures are strangulating and prevent good wound healing by causing infection, seratomas, etc. Freeman's[11] chief concern is in a secure closure of the peritoneum. In one of the responses to his questionnaire, McCauliff[12] noted a method of treatment in which a sterile dressing is placed over the evisceration and the patient is taken to the operating room in his bed. The intestines are then replaced under a small dose of spinal anesthesia. A Penrose drain is inserted and the skin edges are coaptated with wide adhesive strips. A nasal catheter to which suction is applied, completes the treatment. Another method depended upon the imbrication of the rectus sheath for its success. Starr and Nason[13] advise immediate resuture if no marked sepsis is present and the patient is in good condition. They employ spinal anesthesia because the resulting relaxation facilitates replacement of the viscera. The through and through suture is used and a drain is placed in doubtful cases. If there has been considerable handling of the bowel, they perform a Witzel enterostomy and bring the tubing through a stab wound. Shipley[23] favors local anesthesia and using through and through sutures of No. 22 silver wire, placing an ordinary bone button over each end of the wire which is tightened by twisting match sticks down on the button. The gut is protected with gauze which is removed as the wire is made taut. White[8] claims that braided silk is better for through and through suturing because it is more pliable, stronger, and less irritating. Meleney and Howe employ through and through sutures in clean cases. When infection is present, they treat the patient in his bed with heavy doses of morphine, replace the intestine, pack the wound with iodine gauze and draw the skin edges together with adhesive. If necessary, secondary sutures are used at a later date. Colp[5] lists the following methods of treatment:

1. Secondary sutures over a gauze drain;
2. Suture by layers;
3. Suture of peritoneum and packing rest of wound;
4. Packing without sutures;

Grace used the secondary suture in 30 cases and adhesive strapping with or without packing in 16 cases.

CASES OF EVISCERATION AT THE METROPOLITAN HOSPITAL

Case 1. Male, age thirty-eight years was admitted October 14, 1934, with a diagnosis of perforated peptic ulcer and discharged December 4, 1934. Abdominal pain was present about two hours after meals for nine days prior to admission and vomiting had occurred several times. Further relevant history revealed the presence of constipation, absence of blood in stools, no hematemesis and generalized abdominal pain. On the day previous to admission, the pain was so extreme that the patient fell down in the street. Fever and chills were present. The only other important part of the past history was that the patient had received only two months of antisyphilitic treatment ten years ago. Generalized abdominal rigidity with rebound pain and tenderness were the positive physical findings. Rectal examination revealed an enlarged prostate which was tender on the right side. The white cell count was 13,900 with 85 per cent polymorphonuclears and 15 per cent lymphocytes. The sedimentation rate on admission was 1 mm. in fifteen minutes and 4 mm. in an hour. The urine was normal. The postoperative laboratory findings showed a blood sugar of 137 mgms/100 c.c.; nonprotein nitrogen 40 mgms. and creatinine 1.9 mgms. The Wassermann reaction was negative.

Operation: An upper muscle splitting right rectus incision was employed under gas, oxygen and ether anesthesia. Free purulent fluid was found in the peritoneal cavity, but a culture showed no growth in forty-eight hours. The pus was aspirated with the suction pump. The perforation was located on the anterior surface of the stomach ½ inch from the pylorus. The opening was pursestringed and then plicated. This area was next covered with omentum which was anchored with fine catgut. A Penrose drain was placed in the right gutter and brought out at the lower angle of the wound. The peritoneum was closed with a continuous No. 1 plain catgut suture; No. 1 chromic catgut for both rectus sheaths, interrupted black silk for the skin and interrupted silkworm gut retentions including the anterior rectus sheath.

Progress Notes: Postoperative progress was uneventful for three days. The Sippy regimen was started on the fifth day. On the sixth postoperative day, during the interne's attempt at gastric lavage for relief of a slight distention, a violent coughing seizure resulted and was immediately followed by eviscertaion of four feet of small intestine *through the drainage opening.* No omentum was visible. Hot saline packs were applied. Shock was absent. The patient was taken to the operating room and under spinal anesthesia, the gut was replaced and a Witzel enterostomy was performed, bringing the catheter out through a stab wound in the right flank. Except for the original drainage opening which was about ½ inch long, the wound had healed firmly. A Penrose drain was inserted. The wound was closed with through and through dermol sutures. Hypodermoclyses of 1000 c.c. glucose and saline solution were repeated. In the following days the wound discharged pus profusely. The drain was gradually released. The retentions were removed after twelve days and the superficial area of the wound was cleansed and packed with vaseline gauze. The patient continued to improve and was discharged in good condition fifty days after admission.

DISCUSSION

We have failed to find any similar case in the literature of an evisceration occurring through a drainage opening. The intra-abdominal pressure must have been exceedingly great. Since the patient's condition was good prior to the accident and as no omentum was found in the vicinity of the disruption, it is unlikely that a knuckle of gut might have been adherent to the drainage opening which in turn might have served as a starting point for the evisceration. Therefore, we must attribute the accident to the violent coughing spell. The process of evisceration must have been almost immediate and not part of a previous series of pathological events.

Case 11. Male, age sixty-four years was admitted December 3, 1932 with diagnosis of a

ruptured peptic ulcer. He was discharged January 27, 1933. The patient was awakened by a sharp abdominal pain which radiated to the right shoulder, and followed by vomiting. There was a history of "indigestion" for 6 years with pain ½ hour after meals. Tarry stools were occasionally present. Physical examination showed a rigid abdomen with tenderness in the epigastrium only. The urine was normal. The white blood count was 12,400 with 80 per cent polymorphonuclears, 18 per cent lymphocytes and 2 per cent eosinophiles.

Operation: An upper right rectus muscle splitting incision was made under general anesthesia. A small perforation was located on the anterior surface of the pylorus. The rupture was purse stringed and a Penrose drain inserted. The wound was closed as before except that retention sutures were omitted.

Progress Notes: Distention was present during the first and second days. A Levin tube was inserted through the nose and a Harris drip and hypodermoclysis were given. Progress was uneventful until the eighth day when the sutures were removed and after a spasm of coughing evisceration occurred. The patient was taken to the operating room. After replacing the gut, the necrotic edges of the wound were excised, a drain inserted and the wound closed with through and through silkworm gut sutures. The patient's condition on the following day was poor and required a blood transfusion. For the next few days distention and vomiting were treated by the nasal Levin tube. The patient was discharged in good condition forty-seven days later.

DISCUSSION

Here again, increased intra-abdominal pressure was the cause of evisceration. Distention was present immediately after the primary operation. It is probable that the wound was weakened during the first two postoperative days. The final strain occurred during a coughing spasm which completed the evisceration.

Case III. Male, age fifty years, was admitted August 14, 1931 with diagnosis of chronic catarrhal gastritis, chronic interstitial nephritis, perihepatitis and peritonitis. He died October 17, 1931.

This patient was a readmission. In 1930 the left leg has been amputated for frost-bite gangrene. There was a history of untreated chancre thirty-five years ago. On admission the patient appeared undernourished. The positive physical findings revealed an irregularity of the left pupil which did not react to light or accommodation, carious teeth, fecal vomiting and a sensation of a mass at the pylorus. The patient's condition improved until September 3, 1931 when he complained of abdominal pain. At this time abdominal examination showed a right sided rigidity with slight tenderness. The stools were positive for occult blood. A gastric analysis was normal. The patient improved under atropine therapy. On September 11, 1931, gallstones and periduodenal adhesions were diagnosed by *x*-ray. The white cell count on September 28 was 15,000 with 68 per cent polymorphonuclears and 32 per cent lymphocytes. The hemoglobin was 70 per cent.

Operation: September 29 an exploratory laparotomy was performed through an upper right rectus incision under local anesthesia supplemented with gas and oxygen. A chronic productive gastritis, splenitis and hepatitis were found. The usual closure was employed.

Progress Notes: On the following day vomiting was frequent, the pulse was poor and a sanguinous discharge from the wound was observed. The measures employed were glucose and saline solution intravenously and gastric lavage. The vomiting and sanguinous discharge from the wound continued for three days. A supportive abdominal binder was applied. On the fourth day when the wound was dressed, it showed a gaping in the center and was bathed in a purulent discharge. The wound was cleansed and the skin edges were drawn together with flamed adhesive. The patient's condition improved although the wound continued to suppurate. Evisceration occurred on the twelfth day, although the sutures had not been removed. Hot saline packs were applied and heavy doses of morphine were given. The intestines were replaced and retained with iodoform packing. Flamed adhesive was used to coaptate the wound edges. The therapeutic measures employed were intravenous saline, hypodermoclysis and the nasal tube. Shock was present, the blood pressure was 88/58. The patient's condition improved during the next three days but he gradually began to weaken and died six days after the evisceration.

DISCUSSION

Early postoperative vomiting was the exciting factor in this case. Systemic disease was of importance because it predisposed towards this complication.

Case IV. Male, age fifty-five years was admitted March 21, 1934 and died April 4, 1934. He was admitted for an exploratory laparotomy because of an eight months history of vomiting, only a fluid or soft diet being retained. Physical examination showed an undernourished male but not acutely ill. The pupils were irregular and reacted sluggishly to light and accommodation; the teeth were in poor condition; anterior cervical adenopathy was present and the lungs were emphysematous. The abdomen was normal except for a complete left inguinal hernia which was easily reduced. The abdominal reflexes were absent and abnormal reflexes such as bilateral ankle clonus, patellar clonus, positive Babinski and Oppenheim were present. Arteriosclerosis were marked. The urine showed granular casts and a tract of albumin. The Wassermann test was negative.

Operation: April 2, 1934. A left Bassini repair was performed followed by an exploration through an upper left rectus incision. Except for visceroptosis of the stomach and colon, no pathology was found. The usual abdominal closure was done including retention sutures.

Progress Notes: The patient's condition was excellent until the fifth postoperative day when he became irrational and *got out of bed.* Restraint was necessary. However, recovery followed within twenty-four hours. The sutures were removed on the ninth day and the wound appeared clean and healed. A few hours later, evisceration occurred suddenly. An intravenous of saline solution was given and the patient was removed to the operating room. The wound was closed with through and through silkworm gut sutures and a Penrose drain inserted. On the second day after the secondary operation death ensued due to cardiac failure.

DISCUSSION

This case illustrates another type of increased intra-abdominal pressure namely, getting out of bed soon after operation. The disruption probably started when this event took place although the actual evisceration occurred four days later following removal of the skin sutures.

Case V. Male, age forty-eight years, admitted March 7, 1934 for ruptured peptic ulcer and died March 21, 1934. This patient was a readmission. Diagnosis of peptic ulcer was made in December, 1933 and a Sippy regimen advised. The pain present on admission started two weeks previously. Physical examination showed an undernourished male not acutely ill, the carious teeth and pathological abdominal signs.

Operation: March 21, 1934. The abdomen was opened through an upper right rectus incision. Pyloroplasty and appendectomy were performed. The wound was closed in layers and silkworm gut retention sutures.

Progress Notes: The postoperative course was uneventful until the fourth day when the patient became dyspnoeic, coughed and developed tracheal rales and abdominal distention. Signs of pneumonia were obvious. Improvement followed. On the eighth postoperative day, evisceration occurred suddenly. Shock was present. An intravenous of 500 c.c. of acacia in saline was given. The patient was taken to the operating room and under spinal anesthesia the intestines were replaced, the wound drained and then closed with through and through silkworm gut sutures. His condition was poor and another intravenous was given followed by a blood transfusion the next day. Bilateral moist rales were present. He became semicomatose, irrational and died on the ninth day after the primary operation. The sputum was classified as pneumococcus type IV.

DISCUSSION

Distension and cough were responsible for the evisceration.

Case VI. Female, age fifty-two years was admitted April 29, 1933 for cholecystitis and chronic cardio-valvular disease and discharged June 4, 1933. The history of pain in the right upper quadrant was of one year's duration. Thyroidectomy was performed two years prior at the time of the menopause. Physical examination showed an obese female not acutely ill. The heart was slightly enlarged, the sounds distant and the first mitral accompanied by a systolic murmur. The abdomen was slightly

rigid and tender in the right upper and lower quadrants.

Operation: May 3, 1933. The gall bladder and appendix were removed through an upper right rectus incision. The wound was closed in layers, no retentions being used.

Progress Notes: Vomiting, retching and distention were present for four days after operation. The sutures were removed on the eighth day and it was observed that the wound had healed by primary intention. On the tenth postoperative day there was a sudden evisceration of intestines and omentum through the widely disrupted wound. The patient was removed to the operating room where the wound edges were curretted and then closed in layers and silkworm gut retentions. Recovery was uneventful and the patient was discharged in good condition thirty-seven days after the primary operation.

DISCUSSION

Undoubtedly, the increased intra-abdominal pressure due to the vomiting, retching and distention present during the first four postoperative days caused the evisceration which became apparent later.

Case VII. Female, age twenty-three years, was admitted March 8, 1932 with a diagnosis of bilateral oophoritis. She died March 23, 1932. The patient complained of pain in the right lower quadrant of one week's duration and amenorrhea for one year. Menstruation was irregular since 1925. She was married eight years ago; she had had no pregnancies but one miscarriage. On physical examination the abdomen was found markedly obese and the right lower quadrant was slightly tender. Gynecological examination showed a small uterus, enlarged right ovary and tenderness in the right fornix.

Operation: March 16, 1932. A lower right rectus incision was employed. Many peritoneal adhesions were present and a few strong bands were freed. The wound was closed in layers using Michel clips for the skin and silkworm gut retentions.

Progress Notes: The patient's condition was poor immediately following the operation. Her temperature varied between 104° and 106°F. until her death on the seventh day. Generalized erythema and pruritus were present on the second day. The throat was injected. Moderate distention was noticed throughout. Diarrhea was marked on the fourth day. Sudden evisceration occurred on the sixth day, the wound discharging much purulent fluid. The patient was removed to the operating room and after inserting a Penrose drain, the peritoneum and muscles were sutured with No. 2 chromic catgut. The superficial wound was packed with iodoform gauze. Death occurred on the following day.

DISCUSSION

Although distention was moderate, the increased intra-abdominal pressure was sufficient to cause evisceration. The treatment for the disruption was probably ill advised. It would have been better to treat the patient in her bed by the packing and adhesive technic.

Case VIII. Male, age fifty-six years, was admitted January 21, 1932 with a diagnosis of chronic cholecystitis. He died February 16, 1932. There was a history of sudden pain in the upper right quadrant, the first attack occurring one month and the second two weeks previously. Anorexia, flatulence and belching were present. Physical examination showed an obese male suffering from acute upper right abdominal pain. The epigastrium was tender and rigid; also tenderness over McBurney's point. The heart sounds were distant. His blood pressure was 150/98.

Operation: January 30, 1932. The gall bladder was removed through an upper right rectus incision. The wound was closed in layers and dermal retention sutures.

Progress Notes: Marked vomiting persisted for eleven days when evisceration took place. In spite of gastric lavage this complication of vomiting and distention continued. The wound bled profusely on the fourth day. Pain was present prior to the disruption. After the accident occurred, the protruding omentum and intestines were covered with saline packs and the patient was removed to the operating room. The wound edges were found to be dirty grey and necrotic. Two Penrose drains were inserted. Several No. 2 chromic catgut through and through sutures were used for the closure. A Levin nasal tube was inserted on the following day but distention persisted and dyspnoea was marked. Gurgling rales were present in both bases, the heart sounds were distant, and fecal

incontinence supervened. Bleeding in the wound recurred, therefore an abdominal binder was securely adjusted. The patient became irrational, gradually weakened and died on the sixteenth postoperative day.

DISCUSSION

Increased intra-abdominal pressure played a prominent role in the evisceration. Following the secondary suturing, bleeding recurred and it is likely that another disruption would have followed had not death occurred.

SUMMARY

Increased intra-abdominal pressure is the primary factor in the etiology of evisceration and avulsion of abdominal wounds. Other causes mentioned under etiology play only a contributory part. Eight cases of evisceration are reported in all of which increased intra-abdominal pressure was conspicuous. Prophylaxis entails a close observance of the fundamentals of surgical technic and principles. The symptomatology and treatment are presented.

I am indebted to Dr. J. H. Fobes for his helpful criticisms and suggestions in reviewing this paper.

REFERENCES

1. Ducuing, J. The role of phlebitis in precocious spontaneous postoperative evisceration. *La Presse medicale*, 43: 281–282 (Feb. 20) 1935.
2. Horner, D. A. Postcesarean bursting of abdominal wounds. *J. A. M. A.*, 93: 1126–1131 (Oct. 12) 1929.
3. Reid, Mont. R., Linninger, M. M. and Merrell, Paul. Closure of the abdomen with through and through silver wire sutures in cases of acute abdominal emergencies. *Ann. Surg.*, 890–896 (Nov.) 1933.
4. Grace, Roderick, V. Disruption of abdominal wounds. *Ann. Surg.*, 99: 28–33 (Jan.) 1934.
5. Colp, Ralph. Disruption of abdominal wounds. *Ann. Surg.*, 99: 14 (Jan.) 1934.
6. Meleney, Frank, L. and Howes, Edward L. The disruption of abdominal wounds with the protrusion of viscera. *Ann. Surg.*, 99: 5–17 (Jan.) 1934.
7. Cave, Henry, W. Incidence and prevention of incisional hernias. *J. A. M. A.*, 101: 2038–2042 (Dec. 23) 1933.
8. White, William Crawford. Disruption of abdominal wounds. *Ann. Surg.*, 99: 34 (Jan.) 1934.
9. Lakey, Frank, H. The management of some complications following abdominal operations. *J. A. M. A.*, 89: 1735–1738 (Nov. 19) 1927.
10. Baldwin, J. F. Disruption of abdominal wounds. *Am. Jour. Surg.*, 25: 7–11 (July) 1934.
11. Freeman, Leonard. The causes of postoperative ruptures of abdominal incisions. *Arch. Surg.*, 14: 600–604 (Feb.) 1927.
12. McCauliff, Guy T. Ruptures of wounds following abdominal operations. *Jour. Iowa State Med. Soc.*, 23: 347–351 (July) 1933.
13. Starr, Arnold and Nason, Louis, H. Postoperative rupture of abdominal wounds. *J. A. M. A.*, 100: 310–312 (Feb. 4) 1933.
14. Hayner, J. C. Prevention of avulsion of abdominal incisions. *Jour. Am. Inst. Homeop.*, 25: 303–308 (March) 1932.
15. Kennedy, J. W. Tragedies of the abdominal incision. *Am. Jour. Surg.*, 25: 512–520 (Sept.) 1934.
16. Bartlett, Willard and Bartlett, Willard, Jr. The transverse incision in the upper abdomen. *Surg. Gynec. Obst.*, 57: 93–99 (July) 1933.
17. Von Gusnar, Kurt. Rupture of abdominal wall following laparotomy. *Arch. f. klin. Chir.*, 150: 636–645, 1928.
18. Sigalas, M. Postoperative eventration. *Rev. de chir.*, Paris 51: 32 (Jan.) 1932.
19. Hellendall, Hugo. Zur Behandlung der Postoperativen Dehiszenz der Bauchwunde mit Darmvorfall durch den Schnurverband nach Dr. Sarason. *Zentralbl. f. Gynak.*, 55: 2479–2489 (Aug. 15) 1931.
20. Howes, E. L. and Harvey, S. C. Strength of the healing wound in relation to the holding strength of the catgut sutures. *New England J. Med.*, 200: 1285–1291 (June 20) 1929.
21. Weber, M. Zur Frage der Postoperativen Dehiszenz der Laparotomie Wunden mit Vorfall des Bauchhohleninholtz. *Zentralbl. f. chir.*, 53: 277 (Jan. 30) 1926.
22. Pool, E. H. Postoperative treatment. *New England J. M.*, 201: 510–516 (Sept. 12) 1929.
23. Shipley, A. M. Broken down abdominal incisions: a method of closure. *Ann. Surg.*, 82: 452 (Sept.) 1925.
24. Howes, E. L., Sooy, J. W. and Harvey, S. C. The healing of wounds as determined by their tensile strength. *J. A. M. A.*, 92: 42–45 (Jan. 5) 1929.
25. Madelung, O. *Archiv. fur Klin. Chir.*, 77: 345, 1905.
26. Sokolov, S. Postoperative rupture of abdominal wounds with protrusion or prolapse of the viscera. *Ergeb. der chir. und Orthop.*, 25: 306–379, 1932.
27. Glasser, S. Thomas. Ox fascia (dead fascia) graft. *Am. Jour. Surg.*, 19: 542–544 (March) 1933.
28. Brandson, B. J. and Hillsman, J. A. Fluids in surgery. *Canad. Med. Assn. Jour.*, 26: 689–698 (June) 1932.
29. Firor, Warfield, M. Healing of wounds. Dean Lewis, System of Surg. Vol. 1, Chapt. 8, pages 18–23.

SUBPERITONEAL DECORTICATION IN GALL-BLADDER DISEASE

D. PHILIP MACGUIRE, M.D., F.A.C.S.

Assistant Clinical Professor of Surgery, New York Post-Graduate Medical School and Hospital, Columbia University

NEW YORK

THE recent death of Dr. Eugene Louis Doyen, at the early age of fifty-seven, removed a well known figure in surgical circles which was not limited to Paris. Despite the fact that he was unattached to any large hospital or teaching institution, his views on the etiology and treatment of cancer attained worldwide publicity. The micrococcus neoformans, which he first observed in cancerous lesions in 1886, was the causa causans of cancer according to his own belief based on his personal demonstration. A paper written by Drs. A. Paine and J. Morgan, contributed from the Cancer Hospital and published in the Lancet in 1906, was accepted by British observers as conclusive proof that the French discoverer was in error. Nevertheless, Doyen's work was honest and painstaking even though the non-fulfillment of his expectations caused him to become involved in violent conflicts in Cival Courts and with members of his profession. Doyen has been credited as being the pioneer of the cinematograph method for teaching surgical technique. Some of his operations were undoubtedly presented in this manner in 1898.

Doyen used rapid and sensational operative procedures which included the cinematographic method of operation quite similar to the technique of César Roux who was the pupil of Kocher and who eventually excelled his own teacher.

In 1899, Doyen removed a gall bladder subperitoneally, then instituted drainage through the resulting peritoneal sac. He termed this operative procedure "subperitoneal decortication." At about the same time Kehr became dissatisfied with the raw area in the liver resulting in the accepted technique of cholecystectomy including drainage of the common duct by choledochotomy. A combination of these two operative procedures was the operative technique that he described. He invariably used the Kehr incision. Unfortunately, he attempted to use a subhepatic tampon to create a subhepatic barrier by means of inflammatory adhesions, formed at the expense of the neighboring viscera, thus permitting the subhepatic drain to emerge. In 1908, Professor Louis Tixier of the Surgical Clinic of the University of Lyons, France, modified the Kehr method and utilized a simple continuous serous tunnel to hold the drains and the Kehr T-tube for draining the common duct. Kehr adopted the term "subserous resection."

Surgeons should study the Doyen technique, familiarizing themselves with the advantages the subperitoneal procedure offers. This operative method should be applied to all serious and highly inflammatory gall-bladder conditions where performing a cholecystectomy is questionable owing to the pathological condition in and around the gall bladder. This is especially true in cases where the denudation is so extensive that it would result in the exposure of a large absorptive area.

When confronted by such a condition evidencing a serious blood chemistry, indicated by the high increase of cholesterol and esters, bile acids, icterus index, urea, glucose, and uric acid, the author believes that Doyen's procedure is the operation of choice, inasmuchas, the surgeon experiences slight difficulty in pealing off the serous membrane. Undoubtedly, many surgeons will disagree with this opinion. The late John B. Deaver never mentioned

this technique in either his medical writings or his textbook. In severe cases of gall-bladder disease he always advised cholecystostomy. Drainage of the gall bladder has never appealed to the writer, since the postoperative adhesions are so serious that a future cholecystectomy results too often in a high mortality. The retained highly infected mucosa frequently develops into a persistent sinus or a retention of infected material which does not drain.

Kocher designed a hollow sound that greatly facilitated the subperitoneal dissection of the gall bladder. A short time later von Haberer modelled a dissector which he claimed was an improvement of the Kocher instrument.

Elgart reported the removal of the mucous membrane from the body of the gall bladder and curetting the gall-bladder neck in cases of cholecystitis that evidenced a thickened wall and adhesions between the gall bladder and the colon. This endectomy may be indicated in any chronic or acute cholecystitis if the walls of the gall bladder are not gangrenous and the fever is not high.

Von Haberer's modification of the Kocher hollow sound facilitates dissection in those typical cases where a massive infiltration exists in Cabot's triangle. A subserous cholecystectomy should be employed in order to preserve the cystic duct.

SUMMARY

In conclusion, the author believes that subperitoneal decortication is the operation of choice in cases of extremely serious and highly inflammatory gall-bladder conditions. This is especially true when denudation of the liver surface is extensive, resulting in the exposure of a large absorptive area and the blood chemistry indicates the acute and dangerous condition of the patient.

Not only would this operation lower the attendant mortality, but would also spare the patient from further dangerous operative procedures occurring in the secondary operative removal of the gall bladder as, for instance, following a cholecystostomy.

REFERENCES

Andrews, E. W. & Andrews, E. Extraperitoneal drainage of cholecystectomy wound. *S. Clinics North America*, 1: 1197 (Aug.) 1921.

Bickham, W. S. Operative surgery. v. 4, Phila., W. B. Saunders Co., 1924, pp. 436–487.

Biography of Eugene Louis Doyen. *Lancet*, 2: 913 (Nov. 25) 1916.

Buffé, Pierre. De la cholécystectomie sous-séreuse. Etude de technique opératoire. Lyon, 1907, No. 57, 2 p. l., 70 pp. Thesis de doct.

Doyen, E. L. Surgical Therapeutics and Operative Technique. 3 edition, N. Y., William Wood & Co., 1920, Vols. 1–3, p. 121.

Elgart, J. Removal of mucosa in inflamed gall bladder. *Presse méd.* 33: 865 (June 27) 1925. (abstr.: *J. A. M. A. 85: 552 (Aug. 15) 1925*).

Foster, G. S. The technique of cholecystectomy. *Am. J. Surg.* 3: 144–145 (Aug.) 1927.

Gann, D., Jr. Subserous cholecystectomy. *Internat. J. Med. & Surg.*, 44: 214–216 (May) 1931.

Garrison, F. H. History of Medicine. 4 edition, Philadelphia, W. B. Saunders Co., 1929, p. 729.

Gibson, C. L. Aids to cholecystectomy. *Ann. Surg.*, 83: 618–621 (May) 1926.

Kemal, M. Die subseröse Zystektomie und die Versorgung des Ductus cysticus. *Deutsche med. Wchnschr.*, 59: 1505–1507 (Sept. 29) 1933.

Mortimer, E. L. Subserous cholecystectomy. *Am. J. Surg.*, 6: 83–87 (Jan.) 1929.

Pauchet, V. La pratique chirurgicale. xiii, 1929.

Schangel. Subserous cholecystectomy in Kehr's operation. Thesis de doct., Lyon, 1908.

Tixier, Louis. The Kehr subserous operation. *Surg., Gynec. & Obst.*, 53: 65–68 (July) 1931.

Tixier, Louis. Four cases of inflammatory stenosis of main bile duct; Kehr's subserous operation. *Arch. franco-belges de chir.*, 27: 1–9 (Jan.) 1924.

Tixier, Louis. De l'opération de Kehr sous-séreuse. *Bull. Soc. de chir. de Lyon*, 15: 129–133 (Mar.) 1912.

Tixier, Louis. Lithiase vésiculaire, cystique et du cholédoque; opération de Kehr; cholécystectomie sous-séreuse; ablation d'un calcul du cholédoque; drainage de l'hépatique de la cholécystectomie sous-séreuse; fermeture de la fistule biliaire enquinze jours; guérison complète entrentetrois jours. *Lyon méd.*, 111: 224–227, 1908.

Tixier, Louis. Sur le manuel opératoire de la cholécystectomie sous-séreuse. *Bull. Soc. de chir. de Lyon*, 7:164–167, 1904.

Walters, W. & Bollman, J. L. Results of accumulations of bile around the liver; clinical and experimental observations. *J. A. M. A.*, 91: 239–242 (July 28) 1928.

Whitaker, L. R. Subperitoneal cholecystectomy. *Boston M. & S. J.*, 197: 657 (Oct. 20) 1927.

Whitaker, L. R. Subperitoneal cholecystectomy. *Surg., Gynec. & Obst.*, 46: 851–854 (June) 1928.

Yates, J. L. Indications for cholecystectomy and a method of performing it. *Surg., Gynec. & Obst.* 30: 514–518 (May) 1920.

TREATMENT OF ACUTE HEAD INJURIES

JEWETT V. REED, M.D., F.A.C.S.

Assistant Professor of Surgery, Indiana University School of Medicine, Consulting Surgeon, Methodist and City Hospitals

INDIANAPOLIS, INDIANA

MUCH has been written on the subject of head injuries but it is the duty of those who have had unusual experience in this type of injury to express the progress of their observations and conclusions for mutual benefit. An injury to the head or brain does not require the neurosurgeon exclusively, for the average head injury must be treated by the nearest available doctor regardless of his specialty. Every doctor who is likely to be called in such an emergency should have certain definite rules to follow.

The following suggestions are offered as a working guide for those who do not have neurologic aid at their disposal.

All head injury patients may be classed under three groups: (1) those who will recover regardless of the treatment; (2) those who will die in spite of all treatment; and (3) a small group in which the outcome will be entirely dependent upon the treatment employed. In most cases during the first twenty-four to forty-eight hours it is impossible to determine in which group a certain patient belongs.

Most head injury patients constitute a medical rather than a surgical problem, 10 per cent or less requiring surgical treatment. Those few that require surgery during the first to the fourth day may need an operation for one of the three following conditions: (1) a compound fracture of the vault of the skull; (2) a ruptured middle meningeal artery; (3) a simple depressed fracture over a motor area or over the speech area of the brain cortex.

A patient just brought into the receiving ward with evidence of head injury presents bruises or cuts over the head, bleeding from the nose, mouth or ears, discoloration and swelling about the eyes, a state of unconsciousness or a history of a period of unconsciousness immediately following the injury.

Immediately the patient is made warm and quiet. Some head injury patients lie very still while others are restless. This is harmful and must be controlled as soon as possible. Morphine should not be used, as this drug tends to increase the swelling in the already swollen brain. Very frequently morphine increases the restlessness. In most patients rectal instillation of 3 to 6 grains of sodium amytal will quiet them in a few minutes. This dose can be repeated as often as needed to control restlessness. As much as 24 grains has been given in twenty-four hours over a period of several days without harmful results. In a patient who is unusually violent the sodium amytal may be supplemented by ½ grain codeine sulphate, which does not have the harmful effect of morphine. In the case of an unusually violent patient, an ampule of sodium amytal, (7½ grain) may be injected intramuscularly.

As soon as the patient is quieted, all active hemorrhage must be stopped either by gauze packs or ligation. No attempt at suturing or repairing wounds should be made until the patient is out of shock.

Every patient who had had a head injury sufficient to cause unconsciousness is suffering from edema of the brain and the next step is to try to reduce this edema. This is best accomplished by the intravenous administration of 50 c.c. of a 50 per cent solution of glucose, repeated every four to six hours until the patient regains consciousness. In children in which it is difficult to find a vein, or in any patient in which the venous puncture increases the restlessness, dehydration of the brain may

be produced by rectal instillation of two to three ounces of a saturated solution of magnesium sulphate. Of course, one would not give the magnesium sulphate per rectum at the same time that sodium amytal is inserted, but one-half to three-quarters of an hour later.

By this time, someone will most probably demand to know why we do not hurry and have an *x*-ray picture taken to determine whether or not the patient has a fracture of the skull. It is usually very difficult to satisfactorily explain to the family and friends that in the great majority of head injuries we are not in the least concerned about a fracture, that our chief care is the degree of trauma to the brain and that every injured brain needs rest more than anything else. As observation of the patient is continued, circumstances may arise which will make it necessary to have an *x*-ray plate of the skull. These circumstances will be considered as we proceed.

After the patient has been made quiet and has received intravenous glucose or magnesium sulphate per rectum, the head is inspected for wounds. If there are no scalp wounds, or if there are wounds that do not extend to the bone, we can conclude that the patient does not have a compound fracture of the vault of the skull, and therefore surgical treatment, at least for the present, is not indicated. On the other hand, a fracture of the skull may be seen through a scalp wound and we can conclude that an operation will probably be necessary as soon as shock has subsided. Again, a small scalp wound may extend to the bone, but the size of the wound interferes with proper inspection of the neighboring region of the skull. In such a case the possibility of a compound fracture of the vault must be kept in mind and an *x*-ray of the skull should be taken as soon as the patient's condition permits. Thus with our first observations of the patient we can determine whether the treatment will be surgical or non-surgical during the next few hours.

Let us consider first the patient without a compound fracture of the vault. Since no immediate surgical treatment is indicated, our chief duty is to keep the patient quiet and the brain dehydrated. A neurological examination is of little value during the first few hours. Certain features, however, should be observed and noted. Bleeding from the mouth or nose often means a fracture of the frontal fossa of the skull. With such a condition present, the patient's head should be turned to one side so that the blood that runs back into the throat will not interfere with breathing. A mechanical aspirator to remove the blood and mucous from the pharynx is often helpful. Bleeding from one or both ears practically always means a fracture of one or both middle fossa of the base. The only treatment for this is to place a sterile gauze over the ear to prevent the entrance of dust. Edema or hemorrhage of the conjunctiva generally means a fracture of one of the orbital bones. Swelling and discoloration of the eyelids may or may not indicate fracture. For such swollen and discolored eyes cold, wet compresses are advisable. The size and reaction to light of each pupil should be determined and recorded; not that these abnormalities can be remedied, but subsequent pupil changes may be of considerable diagnostic value. The patient should have a gentle inspection of his entire body in search for other injuries. The pulse, respiration, blood pressure and temperature should be recorded at hour or half-hour intervals; these findings do not aid very much in indicating the line of treatment, but they do point towards the prognosis.

As soon as the patient is out of shock, which in the average case is usually between two to four hours after the injury, the question of lumbar puncture is to be considered. Some believe this to be an important therapeutic measure while others insist that it should never be done in head injuries. I feel that the "anti-lumbar puncturists" do not realize the real significance of this procedure. If a lumbar puncture were done with the sole purpose

of reducing intracranial pressure, it would be of practically no value because the intracranial pressure following head injuries is due chiefly to hemorrhage and edema in the brain substance and these can not be modified very much by the withdrawal of cerebrospinal fluid. The only reason for performing a lumbar puncture in a head injury patient is to remove blood from the subarachnoid spaces. Those doing general surgery are constantly reminded of the harm resulting from blood being left in cavities and tissue spaces where it tends to form adhesions. The stiff elbows and knees following mild injuries are most often due to adhesions secondary to blood in these joints. For this reason, blood should not be allowed to remain in the subarachnoid spaces where it may form adhesions and thus interfere with the normal flow of cerebrospinal fluid. Such blockage tends to produce varying degrees of chronic edema of the brain, which in all probability, is an important factor in the later symptoms following head injuries, such as headache, dizziness, sleeplessness and general nervousness.

For this reason most head injury patients should have a lumbar puncture as soon as they have recovered from shock. Those who should not be punctured are those who have a compound fracture of the vault of the skull or a compound fracture of the base, as evidenced by bleeding from the nose, mouth or ears. The reason for this is that in reducing the pressure in the subarachnoid space, even the slightest degree, a negative pressure might be established in the region of the fracture and thus infected material might be sucked in through the rent in the dura and produce meningitis. Again, a lumbar puncture should not be done on a restless patient and thus increase his restlessness.

In most patients a spinal puncture can be done without pain if the area is first infiltrated with a 2 per cent novocain solution. If the fluid obtained is perfectly clear and free from blood, the needle can be withdrawn, as further removal will be of little or no value. If the spinal fluid is bloody, enough should be removed to make the spinal pressure about one-half of the original pressure. If a spinal manometer is not at hand, a glass tube 12 to 18 inches long with a rubber tube to connect with the spinal needle is all that is needed. The relative pressure as compared with the original pressure found on first obtaining the fluid, is all that is necessary. When the spinal fluid is found to be bloody, this procedure is repeated every twenty-four hours until the fluid appears clear. This may have to be continued for several days, even after the patient has regained consciousness.

The physician may now leave the patient in the care of an attendant with instructions as to sedatives and dehydration. The patient should be watched constantly and the findings recorded. A rapidly mounting temperature to 103°F. or over indicates a very grave prognosis. An increasing blood pressure combined with a reduced pulse rate may indicate an increasing intracranial pressure, but the absence of these signs are not a reliable indication that the intracranial pressure is not increasing. Cheyne-Stokes respiration means increased pressure extending to the medulla. The most important signs for which one has to watch are evidences of cortical irritation plus those of an increasing intracranial pressure, as these may point to the formation of an extradural hematoma.

In this group of patients, apparently non-surgical at the start, our chief concern during the first forty-eight hours is the possibility of an increasing intracranial hemorrhage. This bleeding may occur in the brain substance, over the surface of the cortex, or in the extradural space. If the hemorrhage is in or on the brain, little or nothing can be done about it, but if the hemorrhage is in the extradural space from a ruptured middle meningeal artery, an early operation is imperative in order to stop the bleeding and save the patient's life. It is very important to keep

this possibility in mind and to be on the lookout for its occurrence. The chief points to consider are the following:

The patient may have regained consciousness and then lapsed into unconsciousness. This latent interval is very suggestive. With the gradually increasing hematoma, pressure will be exerted over the motor area, frequently leading to one-sided convulsions affecting the face, an arm or leg, or the entire side of the patient. In some cases convulsions are absent, but the side opposite the hemorrhage becomes spastic and frequently followed by a complete flaccidity of the paralyzed side. While these motor changes are taking place, there may be stertorous breathing with Cheyne-Stokes respiration; a rise in blood pressure with a slowing of the pulse and often the pupil on the side of the hemorrhage, which was previously mobile or contracted, will become dilated and fixed. In practically all middle meningeal hemorrhages, there has been a fracture of the temporal bone. Bleeding from an ear combined with these findings would warrant exploring the injured temporal fossa, but absence of bleeding from an ear does not mean that the artery could not have been ruptured higher up. In such a condition with the signs of a localized increasing cortical pressure, we are finally justified in taking an *x*-ray plate of the skull. If no fracture is present in the region of a meningeal artery, we can conclude that the pressure is due to a subdural pathology and an exploration is not indicated. If, however, a fracture in either lateral surface of the skull is found, the subdural space should be explored.

A subdural hematoma from a ruptured middle meningeal artery is a rare occurrence and one that probably is overlooked frequently. As a rule, when such a condition is suspected, it is safer to make a small trephine opening under local anesthesia and explore the temporal fossa than to allow such a condition to progress unrecognized.

Assuming that the patient has showed no signs of meningeal hemorrhage, the treatment still continues to be that of keeping him quiet, reducing cerebral edema and spinal puncture if indicated. Some patients in this group will continue to grow progressively worse and there is practically nothing further that can be done. Others will show signs of regaining consciousness. As soon as they can swallow, they may have water and other liquids in limited amounts. Many patients, however, remain unconscious for days and even weeks, and then we have the problem of feeding. A good rule is the following: After the first forty-eight hours if the patient is still unable to take food, he should be gavaged with a mixture of one raw egg, two ounces of glucose or sugar, ten to fifteen grains of sodium chloride and one ounce of magnesium sulphate the whole mixed with enough milk to make a pint. This should be repeated each day until the patient is able to swallow food.

After a few days, when the patient seems on the road to recovery, it will be time to take an *x*-ray of the skull. In most instances, the only reason for doing this is to satisfy the family and for academic interest. Occasionally, a simple, depressed fracture may be found, but this seldom requires elevation unless the depressed bone is over a motor area, or over the cortical speech center. Depressed bones over other regions of the cortex seldom if ever cause harmful pressure.[4—5]

When the average head injury patient regains consciousness, he is generally restless to be up and going. A patient who has been unconscious for a period of three hours should stay in bed for at least one week. A good general rule is to keep the patient in bed one week for each three hour period of unconsciousness. Any form of activity started too soon is harmful to these patients, but many have to be convinced of this from their own sad experience.

While the patient is convalescing and often for months afterwards, he should limit his fluid intake. The reason for this

is that following a head injury, it is very easy to get a recurrence of edema of the brain. Any excess of fluid tends to produce this condition. Most patients recovering from a severe head injury should limit all fluids to twenty-five to thirty ounces in twenty-four hours.

We now return to the patient as we first observed him and will assume that he belongs to the group with a scalp wound suggesting a compound fracture of the vault. While sponging and cleaning the depth of the wound, we may see a depressed or linial fracture. This generally means that an operation is indicated as soon as the patient's condition warrants it. Before preceding with the operation, it is best to have an *x*-ray of the skull in order to determine the exact shape and extent of the fracture. This condition is the only type of head injury that requires an *x*-ray soon after the accident.

The only reason for operating upon a compound fracture of the vault of the skull is in the hope of preventing infection, resulting in either abscess of the brain or meningitis. The operation consists in doing a debridement, removing dirt and other foreign material, and removing enough of the bone fragments to inspect the underlying dura, which if found torn should be tightly sutured. The remainder of the wound is closed in layers without drainage.

There are instances in which even a compound fracture of the vault should receive nothing more than a gentle debridement with closure. Such cases are those in which the compound fracture is over one of the large dural sinuses. In such a case a depressed fragment may be plugging a tear in one of these venous sinuses, and on elevating the fragment a fatal hemorrhage may result. Confronted with such an alarming situation, the only thing to do (except for the most experienced) is to pack the wound with gauze and withdraw. For this reason, a compound fractive over a venous sinus had better be handled in a very conservative manner, because the danger from meningitis is less than the danger from an alarming hemorrhage.

SUMMARY

In the case of acute head injury, our main concern is to keep the injured brain as quiet as possible. Edema of the brain should be combatted by means of dehydration. Blood in the subarachnoid space should be removed.

Compound fractures of the vault of the skull should be explored and the dura closed, except in those cases where the fracture is over a venous sinus. Signs of a ruptured middle meningeal artery should be explored as soon as suspected.

Simple depressed fractures of the skull are of little significance and require no treatment unless they are over a motor area or the speech area of the cortex.

REFERENCES

1. Bagley. Blood in the cerebro-spinal fluid. *Arch. Surg.* July, 1928.
2. Winkleman and Fay. The pacchionion system. *Arch. Neuro. and Psych.* Jan., 1930.
3. Pancost and Fay. Encephalography. *Jour. of Radiology* Aug., 1930.
4. Naffziger, Howard C. Depressed fractures of the skull. *Surg. Gynec. Obst.*, 56: 1933.
5. Naffziger and Glaser. Experimental study of the effects of depressed fractures of the skull. *Surg. Gynec. Obst.*, 51, 1930.

DIAGNOSIS AND TREATMENT OF ECTOPIC (TUBAL) PREGNANCY

WILLIAM M. JOHNSTON, M.D.

AKRON, OHIO

HAVING successfully treated eleven successive cases of ectopic (tubal) pregnancy in the last few months, I would like to review briefly the symptoms, diagnosis and treatment of this rather dangerous emergency.

Etiology. In brief anything which prevents the normal decent of the ovum to the uterus is quite liable to cause a tubal pregnancy. The uterus responds to the hormone stimulation early in ectopic pregnancy, as when the pregnancy is in the uterine cavity. The uterus is enlarged softened and all its elements become hypertrophied. True decidua forms in the uterus and continues until the ectopic pregnancy is disturbed by death of the ovum or external or internal rupture; the decidua then degenerates, bleeds and is cast off. This fact explains why in an ectopic pregnancy the uterus is enlarged practically the same as in the normal pregnancy.

There are two schools of thought as to what the primary causes might be, whether it is the ovum or the tube itself.

The first group believe the cause is in the ovum and explain it by the "Site of Fertilization." The work of His, Bischoff and Strassman would seem to indicate that it occurs in the fallopian tube. If this is true, then every pregnancy begins extra-uterine and ectopic implantation may be said to be due to retarded advance of the fertilized ovum.

The second group believe it is due to obstruction which may be: (1) pressure of tumors; (2) adhesions or inflammatory masses in the pelvis; (3) salpingitis. In my experience this form of infection was present in a large percentage of cases. I believe that in a number of cases a careful history would reveal this to have occurred some months or years previous to the ectopic pregnancy. Salpingitis destroys the cilated epithelium of the tube and narrows the lumen.

Decidua vera or parietalis formation takes place in the uterus; and only small isolated islands of decidua are found in the tube. Implantation occurs in the usual way by the eroding action of the trophoblast bringing chronic villi into the direct contact with tubal musculature. The rapidity of cell division of the ovum by which it may become too large for the tubal lumen is not definitely known, nor how soon it reaches the trophoblastic stage in which it has the power to digest its way into the tube wall, nor do we know the amount of membrane granuloma which may adhere to the ovum making passage difficult. As the ovum developes it bulges into the tubal lumen, pushing part of the tube wall before it. Then it comes in contact with the opposite wall, this is stretched and bulges into the opposite direction, the whole lumen being greatly dilated.

Diagnosis. The diagnosis can be roughly divided into three divisions.

(1) Before rupture; (2) beginning rupture or abortion; (3) after rupture.

The term rupture includes internal rupture or tubal abortion as well as rupture through the tubal wall. Symptoms of early ectopic pregnancy may simulate any abdominal condition and the best diagnosis is made by a complete and careful history. In taking the history inquire as to the sterility; if the patient has been married for several years and never became pregnant or even if a one child sterility is present, it should be a hint. Previous laparotomy especially if the patient had a conservative operation and the tubes are present is suggestive; previous pelvic infection is found in a large number of cases.

Abnormal Menstruation. A missed period is always a presumptive sign of pregnancy but a patient often wants "To wait until next month and see if menstruation will take place then." Some believe they are normally pregnant and wish to wait until next month before consulting a physician. Postponed, prolonged or otherwise abnormal menstruation are very suggestive.

Authorities quote different figures in the history of menstrual disturbances, ranging from 81 per cent of Howard Taylor to 96 per cent of Polak, the latter reviewing 271 cases. This figure, in our experience, is more nearly correct as we found a history of some menstrual trouble in each case. However, some patients take no notice of their menstrual periods.

Subjective symptoms and vaginal bleeding are rare before rupture, small cramp like pains, slight discomfort and soreness are some of the complaints, but are not severe enough to consult a physician.

Pelvic Examination. Authorities say that the cervix is likely to show a little softening and slight discoloration at this stage, however, in the cases I have seen before rupture I have not been able to definitely demonstrate this. The uterus is slightly enlarged and softened, but Hegar's sign and characteristic feel of the pregnant uterus are lacking. A mass is difficult to feel at this stage and is more often missed than found. There is no blood in the peritoneal cavity, so no fever or leukocytosis is present. In fact all symptoms are so moderate and the physical findings so vague that the physician who makes a diagnosis at this stage should consider himself fortunate. Recently by the use of Ascheim-Zondek reaction presumptive pregnancy may be ascertained, however, this is not 100 per cent true.

Clinically the best time to make a diagnosis is at the beginning of the rupture or abortion because operation can be done before any dangerous hemorrhages occur. The symptoms are very similar to those before rupture except that they are more definite.

Intermittent, irregular, brownish red and unclotted bloody vaginal discharge, dribbling or spotting in character, is one of the significant signs of beginning rupture, abortion, or death of the ovum. Rarely the bleeding may be quite profuse and clotted.

Pain. According to Wynn, pain occurs in 84 per cent, Farar states 96 per cent; in our cases it occurred in all but one. The pain is cramp like, sharp, stabbing and if on one side of abdomen points strongly toward tubal pregnancy and is a very important point in diagnosis in this stage. Even soreness or pain on defecation if not present previously must not be overlooked. If this pain is followed by relief for a few hours, several days, or even weeks then recurring, it is a very significant fact.

Physical examination at this stage will show an enlarged soft uterus, so that differentiation must be made between a normal and a tubal pregnancy. If tubal both Hegar's and Brawn Van Ferwald's signs are absent. The cervix is somewhat softened and slightly dilated. Some authorities say there is a bluish color of the cervix, but in many cases this was not marked. Before rupture the mass is small but as it increases in size from hemorrhage or growth of the ovum it can be felt at either side, behind or sometimes in front of the uterus. It is tense and very tender. Enlargement of this mass means increased bleeding and should warn that rupture may be expected.

Generally the physician is not called until rupture has occurred, or if the physician has seen the patient previously, expectant treatment for too long a time is often advised. After rupture occurs the diagnosis is not difficult to make. Patient has severe pain, is pale, in marked shock, her pulse is rapid and weak, a very low or absent blood pressure reading, and her abdomen is rigid. Emergency measures, a rapid operation and transfusion are the methods of treatment.

Laboratory Findings. In these cases the hemoglobin and blood count are usually low due to the hemorrhage. The white

count is increased because of the free blood in the peritoneal cavity.

Treatment. Treatment is surgical; there is no other.

When a patient is seen before rupture occurs an ordinary laparotomy should be done and the tube removed. If the patient is in very good condition the appendix or any accompanying pathology can be excised.

After tubal rupture the patient is in severe shock and a large hypodermic injection of morphine should be given immediately. An intravenous solution should be started before the operation. The patient should be operated rapidly and the bleeding tube removed. Nothing else should be done in the abdomen.

An autotransfusion should be given at the same time if no infection is present. As soon as the patient is in the hospital donors should be typed for blood transfusion which should be given simultaneously or immediately after operation. Donors should also be available for possible transfusion repeated several hours later as a reaction occurs a few hours postoperatively and this crisis may be overcome by a second blood transfusion.

Anesthesia. I have found spinal anesthesia very successful as it prevents the patient from struggling, this prevents increased bleeding, a very important factor in excessive hemorrhage. I have used it in the cases of marked shock and almost absent blood pressure with no ill results, and can highly recommend it to those who understand the technique of its use.

Following is a brief review of the 12 cases:

Case I. M. H., admitted February 6, 1934.

History. This patient had missed one menstrual period in August, 1933. In September, 1933 she had some bleeding for two weeks with regular pain on left side. Diagnosis of probable ectopic pregnancy was made by two physicians but she refused operative interference. She was referred to us the latter part of January, 1934 for pelvic discomfort. Abdominally there was some tenderness above the left rectus muscle. *Vaginal examination* revealed some irregularities of the uterus and a small mass in the left adnexal region.

Operation. February 7, 1933. The left tube was enlarged to four or five times its normal size, gangrenous in its distal half and contained a small mass which was probably a former ectopic pregnancy which had died. The left ovary was cystic and contained a large hemorrhagic cyst. There were two subserous fibroids in the uterine wall. The appendix showed evidence of chronic infection. A few adhesions were around the right tube and ovary but the tube and ovary were not pathological.

Pathological diagnosis: Ectopic pregnancy.

The patient made a good recovery.

Case II. K. G. was admitted March 3, 1934.

History. Four years ago patient had an ectopic pregnancy in right tube and was operated. Her last menstrual period was February 6, 1934; the previous period was on time and of usual duration and amount. Since her last period she has had irregular bleeding and passed a few clots, three weeks previously. The last week or so she had nausea in the morning and cramp like pains in the left lower quadrant.

Vaginal Examination. The patient was somewhat tender from her former operation. Examination was very difficult because of much tenderness of the uterus.

Operation. There was a midline scar in the abdomen from a former incision. Findings were an ectopic pregnancy of the left tube which had ruptured with a large clot of blood, about three inches in diameter in the left side. There were many adhesions to the loops of ileum from the former operation. The appendix was buried beneath the cecum and showed evidence of a former infection. The left tube and the appendix were removed.

Pathological Diagnosis. Ruptured ectopic pregnancy.

The patient left the hospital in good condition.

Case III. H. M., admitted October 8, 1934.

History. Onset about one week before admission with severe cramps in lower abdomen, worse on the left side. These became much worse about four days before admission when she was seized with a sudden severe pain in left lower abdomen and became weak and had a severe chill. Last menstrual period was August 20, and was normal; no menses on September 20. Following the severe pain and chill began

to have some vaginal bleeding which was darker in color than normal. Two days before admission she had more pain and chills, the pain then becoming steady with increased soreness but without cramps.

Vaginal Examination. Tenderness of uterus on palpitation and fullness in the left tube were palpated.

Operation. Slightly enlarged uterus with dilated cervix which on curetting yielded decidual membrane. There was a pregnancy in the left tube at its distal third and a large blood clot in the abdominal cavity. In the lower portion of the abdominal cavity was blood clotted. The cecum was somewhat adherent and the appendix was slightly injected and enlarged.

Pathological Report. Left tubal pregnancy.

The patient made a good recovery.

Case iv. F. S., admitted October 20, 1934.

History. Patient missed one menstrual period and took quinine in an attempt to abort. One week ago she began to bleed which she thought was her regular monthly period but had not bleed for twenty-four hours previous to her attack. She had cramp like pains in her abdomen and fainted while preparing to go out. Her husband called a physician on the telephone asking his advice for her fainting, but did not tell the physician anything of her past experiences. The physician suggested her remaining in bed.

She remained in bed, the abdominal cramp like pains continued and she became very weak. In the morning she was hospitalized.

She gave practically a negative history except having missed one period. She had two normal previous deliveries.

Operation. Under spinal anesthesia the abdomen was opened and a tube ruptured near the junction of the uterus was found. The tube was removed and 1,000 c.c. free blood was used for an autotransfusion. Patient was returned to bed in fairly good condition. A few hours later 600 c.c. of whole blood given intravenously.

The patient left hospital in eleven days, having made a good recovery.

Case v. E. B., was admitted October 25, 1934.

History. Patient's last menstrual period was November 9, 1934. She missed her regular period on December 9, 1934, but on December 15, 1934, began to have some dark spotting. She felt generally ill and had cramp like pains.

Physical Examination. Patient was very tender, and it was difficult to palpate any abnormalities of adnexa, but there was more tenderness on the right side. The diagnosis was based on her history. On December 26, 1935 she was operated, an unruptured right tubal pregnancy with some free blood in abdominal cavity being found. She made a good recovery.

Case vi. F. S., was admitted May 1, 1935.

This was her second admission; she was Case iv of our series admitted in October, 1934.

History. Patient was admitted to the hospital at 3:00 A.M. She gave a history of having her last menstrual period in March 5, 1935 and missed in April. Before her admission she began to have slight persistant bleeding, accompanied by slight pain in the lower abdomen. Three days previously she had some nausea and vomited. The pain and shock was similar to her previous attacks so she called her physician at once.

Operation. Left tubal pregnancy which had ruptured was found. The appendix was removed also.

The patient made a good recovery the second time.

Case vii. V. F. was admitted May 4, 1935.

History. This patient was admitted in severe shock with abdominal pain and secondary anemia. She was married for seven years and although desirous to have children never became pregnant. Five years ago had an attack of pain in both sides and elevation of temperature, which was suggestive of salpingitis. Her last menstrual period was on March 28. About three weeks later patient had some vaginal bleeding and slight pain in abdomen; she thought and hoped she was normally pregnant. About three days before admission she had had severe abdominal pain, relieved somewhat by sedatives.

On the morning of her admission patient had severe abdominal pain and fainted. She was taken to the hospital in severe shock. The foot of her bed elevated and intravenous was started at once. Donors were typed for blood transfusion, 1000 c.c. of glucose and normal saline given preoperatively.

Operation. Abdomen opened and left tubal pregnancy with a large amount of free blood in the abdomen was found. There was also evi-

dence of an old chronic salpingitis. Autotransfusion of 1000 c.c. blood was given.

The patient made a good recovery and went home in ten days. We believe that the old salpingitis was the causitive factor in this case.

Case VIII. C. W. was admitted May 30, 1935.

History. Patient first seen on April 30, 1935 when she had severe pain in the right side of her abdomen, but no shock. She had a similar attack of pain about one year ago and her physician told her she had chronic appendicitis. On our examination her temperature was normal; the pain was too severe for appendicitis and also she had had mild cramp like pains for the previous three weeks.

Pelvic examination showed chronic bilateral salpingitis.

Past History. She had had abdominal pain on both sides. The last menstrual period was during the first week of March and she was going to have an abortion done.

This case was diagnosed as probably an early ectopic pregnancy and suggested hospitalization and possibly be operated the next day. As the patient felt much improved the following day surgery was refused and she left the hospital.

Thirty days later she called her physician at three o'clock in the morning and he called me. We both felt sure she had ruptured ectopic pregnancy. When seen later at the hospital she was in severe shock and had marked evidence of anemia.

Operation. Intravenous was started on the operating table and she was operated very rapidly. A ruptured tube and free blood were found in the abdominal cavity. Because of the chronic infection of the tubes the blood in the abdominal cavity was not used for autotransfusion; 500 c.c. of glucose was given intravenously.

A few hours after operation a transfusion of 600 c.c. of whole blood was given. Patient made good recovery.

At our first visit the patient no doubt had an ectopic pregnancy, which ruptured at the time of her second admission. Salpingitis was probably the cause of the tubal pregnancy in this case.

Case IX. B. T. was admitted September 11, 1935.

History. Although patient had been married six years she had never become pregnant, but had never done anything to prevent pregnancy. Patient had intermittent abdominal pain. She missed her regular period of June 12, 1935, and in July, 1935, began to bleed; this was not a regular menstrual period for the bleeding was of a dark chocolate color. Her family physician thought she had an ectopic pregnancy.

Vaginal Findings. An enlarged uterus with a mass on the right side was palpated. Patient was sent to the hospital the next day.

Operation. The abdomen was opened and a right tubal pregnancy was found. The tube was removed. The left tube was completely sealed off from an old infection. Salpingitis was again the cause of an ectopic pregnancy.

This case was seen before rupture and made a good recovery. The patient left the hospital in ten days.

Case X. C. N. was admitted September 30, 1935.

History. The patient's chief complaints were abdominal cramps and bleeding. There was tenderness in both lower quadrants. Patient had had an appendectomy performed several years ago. Her last menstrual period was July 19, 1935 which was normal. She missed her August period and ten days later she began to flow irregularly, fairly large amount at times but dark in color. One week before admission patient had an attack of pain in the left lower quadrant. These attacks continued and were very severe. She was seen by her family physician who sent her to the hospital.

Vaginal Findings. Bilateral tenderness with apparent mass on each side was felt.

Operation revealed a left tubal pregnancy with beginning rupture and a right ovarian cyst with chronic salpingitis. Both tubes and the right cystic ovary were removed.

The patient made a good recovery.

Case XI. E. E. was admitted October 13, 1935.

History. Patient missed her last menstrual period in September 9, 1935. Ten days after her regular menstrual time in September she began to have spotted, intermittent bleeding. One week before her admission to the hospital she began to have cramp like pain in her abdomen and in October 12, 1935 she began to have more severe pain, worse than at any time since the onset of her illness. In the morning of her admission to the hospital she had excruciat-

ing pain, more marked in the left side, was in early shock and very anemic.

Vaginal examination revealed a somewhat large and tender uterus. Patient was tender throughout the entire pelvis but more marked on the left side, where a mass was present.

Operation. Intravenous glucose was given preoperatively. There were evidences of an old chronic bilateral salpingitis and a left unruptured tubal pregnancy about two inches in diameter. The ovaries were normal, there was a pint of free blood in abdominal cavity. The usual abdominal incision was made. The free blood in the abdominal cavity was removed by suction and the clots removed from pelvis. The left tube resected, after which the abdomen was closed.

The patient made an excellent recovery. It was unnecessary to give a blood transfusion. The patient left the hospital on the eighth day.

Case xii. A married woman of twenty-seven years, admitted with a history of irregular bleeding, was operated February 26, 1936.

History. Her last normal menstrual period was during the first week in December. She had persistent intermittent bleeding since the last week in December. At times this bleeding was profuse, at other times dark brown and scant. She was hospitalized by her family physician as a possible incomplete abortion.

Past History. An appendectomy and Baldy-Webster suspension of the uterus was done in 1928; positive Wassermann reaction four years ago which was treated and the blood rendered negative and seven months miscarriage in 1934.

Physical Examination. An enlarged uterus, a mass in the right pelvic region and bilateral tenderness were palpated. The abdomen simulated salpingitis. The temperature was 99°F.

The blood count showed 3,870,000 erythrocytes, hemoglobin 71 per cent and 9200 leucocytes.

Operation. No uterine contents were obtained by curettage. A needle puncture in the posterior cul-de-sac revealed blood. Under anesthesia the mass in the right pelvic region could be felt more definitely. On opening the abdomen through a midline incision the uterus was found to be increased to about the size of a two months pregnancy, and a right tubo-ovarian mass which included the placenta and disintegrated fetus. There were several adhesions between the omentum and the uterus from the former operation. There was 300 c.c. of free blood which was removed with sterile suction and returned with saline to the patient's vein by autotransfusion. The right pelvic mass which included the disintegrated pregnancy and ovary was removed en masse. The uterine area was well peritonized and the abdomen closed. The patient was transfused within twenty hours receiving 600 c.c. of blood. To date she is making an excellent recovery.

SUMMARY

1. The diagnosis and treatment of ectopic (tubal) pregnancy is reviewed.

2. Several causes of ectopic pregnancy are discussed.

3. The diagnosis of tubal pregnancy is considered (a) before rupture; (b) beginning rupture or abortion; (c) after rupture.

4. The physical findings of this condition are described.

5. The treatment is surgical, there is no other.

6. A brief review of 12 successive cases is given.

REFERENCES

1. Williams, J. W. Obstetrics, Ed. 5, New York, D. Appleton and Co., 1923.
2. Extra Uterine Pregnancy, Nelson Loose Leaf Surgery. Thomas Nelson and Son.
3. Curtis. Obstetrics and Gynecology. Philadelphia, W. B. Saunders Co., 1933.
4. Dauson. Auto-Transfusion. *Med. J. Australia*, 259–50 (July) 1930.
5. Litzenberg, J. W. Extra Uterine Pregnancy.
6. Mueller, C. W. Ectopic Pregnancy. *Amer. J. Surg.*, 42–47 (July) 1935.

DIAGNOSIS AND TREATMENT OF CANCER OF PELVIC COLON AND RECTUM*

J. W. THOMPSON, M.D., F.A.C.S. AND H. W. SOPER, M.D., F.A.C.P.

ST. LOUIS, MISSOURI

THE late Dr. John T. Hodgen advised his students to present their failures rather than their successfully treated cases, inasmuch as we are apt to acquire more knowledge from a contemplation of our deficiencies and disappointments. In the campaign against cancer the clinician is so frequently baffled in his attempts to cure that he needs the encouragement of at least a few cases which terminated favorably. In this paper we wish to present an analysis of a series of patients afflicted with cancer of the pelvic colon and rectum, a region of the body in which early diagnosis and effectual treatment presents exceptional anatomic difficulties.

The diagnosis depends largely on the systematic use of the proctosigmoidoscope. Since 1908 an inflexible rule in the clinic has been maintained that every patient coming for general examination must be subjected to proctosigmoidoscopy. The technique has been published elsewhere.[1] In 1916[2] attention was called to the frequency with which polypi of the rectum and sigmoid undergo malignant degeneration. In 1930 our results in the treatment of cancer of the rectum and pelvic colon by diathermy were presented[3] and emphasizing the dangers and limitations in the employment of radium in this region of the body. Since this paper was published a large number of early cancers and precancerous lesions have been treated by diathermy in the clinic and we wish to reiterate our stanch commendation of the method.

The classic history and symptoms of malignancy of the colon and rectum have been taught erroneously and disastrously. The early diagnosis depends on "cancer-consciousness." The early lesion produces no definite symptoms. A bizarre indigestion, a sensation of abdominal fullness, slight constipation or diarrhea, all may be the initial symptoms of pelvic colon cancer. Pain is absent in early lesion unless the anal canal is involved. Obstructive symptoms occur only in late and usually inoperable growths. *The history of the patient's observation of blood in the feces should always excite the suspicion of cancer.*

Diagnosis of growths occurring above the reach of the sigmoidoscope require the aid of the barium enema and roentgen ray. Because of the variability of the length of the pelvic loop, its mobility and tendency to overlap and obscure the outline of portions of the gut, extreme difficulty is experienced, particularly in non-obstructive lesions. The fluoroscopic technique is of great importance.

The barium enema should be given with the least discomfort to the patient, i.e., by gravity pressure rather than force. Instead of the old reservoir elevated high in the air and with a rubber bulb pump attachment, our barium enema equipment consists simply of a large glass funnel, rubber tubing, and a large caliber metal tip especially designed by Dr. R. Walter Mills. This gravity flow method permits regulation of the flow of the barium by raising and lowering the funnel, or to drain the barium solution from the lower colon if necessary. Filling defects of the pelvic colon are difficult to demonstrate due to spasms, position of the patient and lack of canalization. Usually the oblique position separates the pelvic loop. Correct position is obtained by rotating the patient under the fluoroscopic screen before roentgenograms are made. A series of films taken at different angles will usually localize the

* Soper-Mills Gastroenterology Clinic.

lesion. Skiabaryt, which consists of barium and a suspension medium, has proven very satisfactory. The formula which we have employed is a mixture of five ounces of Skiabaryt to each quart of water.



Fig. 1. Case 11. Note slight irregularity in loop of pelvic colon which proved to be the location of the growth. Observe how easily such defects can be obscured by over-lying loops of redundant pelvic colon. The constant finding of blood on an applicator through a sigmoidoscope materially aids the diagnosis.



Fig. 2. Showing normal canalization of colon after closure of colostomy. Since operation stools negative for occult blood (guaiac test). Barium enema check-up repeatedly negative. Patient well four and one-half years after resection.

operation adapted to the exigencies of the individual case. Each patient must be considered on the basis of his general condition, his constitutional vitality and the particular local conditions about the lesion. The same general principles in treatment of

Table 1

Summary of Results in Surgical Management of Carcinoma of Rectum and Pelvic Colon

Site of Carcinoma	Total No. of Cases	Operable	Inoperable	Per Cent Operability	Hospital Deaths	Mortality Percentage	Cause of Death
Rectum	20	12	8	40	2	10	1 Peritonitis 1 Bronchopneumonia
Recto-sigmoid	15	10	5	66 6	1	6 6	Bronchopneumonia
Pelvic colon	18	9	9	50	1	5 5	Separation of wound, evisceration, peritonitis and pneumonia
Rectum with attachment to uterus	1	1					Died after 2½ years of recurrence in pelvis
Total cases	54	32	22	59.2	4	7 4	N. B. Cases classified as hospital deaths only if expired in less than 30 days. Reason, some of palliative cases wished to remain in hospital until exitus rather than return home, though able to do so.

The surgeon is confronted with the difficult problem of selecting the type of carcinoma elsewhere in the body should apply in the lesions of the colon and

rectum; namely, radical extirpation or destruction of the neoplasm. Accordingly, surgery is recommended for all except the



FIG. 3. Photograph of gross specimen, typical of early, slow growing adenocarcinoma of low degree of malignancy. Graded II by microscopic examination by Dr. Ralph Thompson.

very early and relatively benign adenomatous polypi some of which undergo malignant change very slowly and are readily destroyed by electrocoagulation through a proctoscope.

Growths situated at or below the peritoneal reflection of the rectosigmoid in the majority of instances, are suitable for a radical abdominoperineal type of operation, several modifications of which have been described by Miles,[4] Rankin,[5] Lahey,[6] Coffey,[7] Bartlett[8] and others. This operation can be done in one or two stages according to the local anatomic and pathologic changes or dependent on the patient's general condition. A modified Kraske or posterior resection as recommended by Sistrunk[9] can be applied to low lying growths of the ampulla recti or those situated in the anal canal or just above it. The author (J. W. T.) has most frequently employed this type of procedure as shown in the Table III. The double barrelled colostomy loop, however, is not as satis-



FIG. 4. Showing the case of large inoperable carcinoma of pelvic colon. Growth fixed to surrounding structures and pelvic wall. Note that the colon canalizes readily. This lesion too high for visualization through sigmoidoscope.

factory as the single barrel type manufactured in the abdominoperineal procedure.

Operations designed to preserve the anal sphincters are ideal only in conception. Their practical application is limited to a very selected small group of cases as recommended by Vernon David[10] and Dixon.[11] By far the larger number of patients will be cured of cancer by close adherence to the classic surgical principles in treating cancer, radical removal of the growth and everything around or near it including the regional lymphatics wherever it is technically possible.

Growths higher in the rectosigmoid and pelvic colon can be readily managed by an abdominal approach. Here again individual practices and opinions vary considerably. The so-called obstructive type of resection based upon the Mikulicz-Paul principle is probably the safest and more generally applicable. Anatomic variations and the situation of the growths frequently influence the selection of operation. The end to end type of anastomosis in one stage can

be done safely in early cases to the patient's great advantage. A period of invalidism due to the temporary fecal fistula is avoided, convalescence is much shorter and hospital charges are reduced. Unfortunately such cases are seen rather seldom. The tables show that this was possible in only 5 instances. The Balfour-Morrison[12] tube resection method was used in 2 instances with excellent results in both.

A study of the accompanying tables will make clear the results obtained by the author, (J. W. T.) in a personal series of 54 operative cases of cancer of the rectum and pelvic colon. The good results and favorable mortality rates are undoubtedly due to the fact that the majority of these were diagnosed very early in the course of the disease. This statement is borne out in the low general operative mortality rate, 7.4 per cent.

The tables summarize briefly our experience in the surgical management and

Table II
SUMMARY GUIDE TO PROGNOSIS

	Resected Cases		Palliated Cases	
	Number	Per Cent Mortality	Number	Per cent
Operative deaths...	4	12.5	0	0
Died since operation	4	12.5	16	72.3
Alive 5 years or longer after operation...	12	37.5	0	0
Alive less than 5 years (more recent cases)	12	37.5	6	27.2
Totals.....	32		22	

Total number of patients operated..... 54
Total cases resectable..... 32
Palliative colostomy or exploratory only..... 22
Total hospital deaths..... 4
Combined operative mortality for series..... 7.4

N. B. No immediate operative mortality in palliative procedure or exploration. Several patients remained in or returned to hospitals until exitus.



Fig. 5. Large filling defect in pelvic colon. Note easy canalization. Metastasis present in liver. No operative procedure. Exitus several weeks following examination.

Table III
SUMMARY OF TYPE OF OPERATION EMPLOYED IN RESECTED CASES

Type of Operation	Number	Operative Deaths	Per Cent	Died Since	Per Cent	Remarks
One stage abdomino-perineal resection.....	4	0	0	1	25	Recurrence
Two stage abdomino-perineal.....	3	0	0	0		
Modified Kraske posterior resection.....	9	1	11	1	11	Recurrence
Obstructive resection.....	10	1	10	2	20	Metastases
Aseptic end to end.....	3	Bronchopneumonia	33.3			
Tube resection.....	2	0	0			
Harrison-Cripps.....	1	1		..		Died of sepsis (pelvic abscess)
Totals.....	32	4	12½	4	12½	

end results obtained. The importance of centralization of these cases and intelligent cooperation between clinician and surgeon cannot be overemphasized. Bargen,[13] among many others, has repeatedly extolled the virtue of adequate preoperative preparation of the bowel through decompression, even employing cecostomy in obstructed cases. A series of mineral oil retention enemas employed prior to operation have been of great value. Vaccination to stimulate the defensive properties of the peritoneum has apparently assisted in diminishing operative mortality.

CASE REPORTS

Demonstrating Curability of Cancer of Rectum and Pelvic Colon

Case I. Female, age forty-six years, entered the clinic May 8, 1929, with complaints of constipation and intestinal gas. For the past year she had observed blood droplets in the feces after saline purgation. Her general condition was excellent, there was no weight loss. *X*-ray films demonstrated the presence of diverticulosis of the descending and iliac colon. Sigmoidoscopy disclosed a polypoid walnut size growth on the anterior wall at the 8 inch line. It was irregularly nodular and bled easily. At operation was found a carcinomatous polyp, Grade 1, in the sigmoid. It was on a long pedicle but in removal this was excised down into the normal tissue. Resection of a segment of bowel was not done inasmuch as the malignancy was of low grade. The patient has been under observation since the operation, with sigmoidoscopy done at least once a year and she has remained in splendid health six and one-half years.

Case II. Female, age forty-four years, admitted March 23, 1931, in good general health with no weight loss. She has always been constipated and therefore a habitual cathartic taker. For past year she noticed blood in the feces which she attributed to hemorrhoids. Sigmoidoscopy revealed normal mucosa and strongly contracted rectosigmoid. She was given a course of oil enemas and a 10 inch view was finally secured. *A 12 inch cotton applicator always came back blood stained.* Barium enema revealed an indistinct irregularity in the outline of the pelvic colon for a distance of 3 inches. April 18, 1931, under spinal anesthesia, the abdomen was explored through a low left rectus incision. A cancer of the ileopelvic colon was found just above the rectosigmoid juncture. (See figures.) The remainder of the abdominal viscera and all peritoneal surfaces were carefully examined and no gross evidence of metastases or malignant peritoneal implantations were found. An obstructive type of resection was performed employing Rankin's clamp for the purpose. The patient made a good postoperative recovery. On July 29, 1931, the colostomy was closed, again using spinal anesthesia. Ultimate complete restoration of colonic function was obtained. She has been in *good health four and one-half years after* operation.

Case III. Male, age forty-seven years, was admitted September 21, 1925, in good general condition with no weight loss. He first saw blood in his feces one year ago. For the past six months constipation and frequent attacks of diarrhoea with passage of considerable mucous and blood has been present. Proctosigmoidoscopy revealed an adenocarcinoma at the 5 inch level, the size of a walnut with a broad base. At operation, October 5, 1925, colostomy was done and three weeks later 10 inches of the colon was resected and end to end anastomosis made. The pathologist reported carcinoma with glandular involvement. January 23, 1926, proctosigmoidoscopy revealed ten small polypi approximately at the site of suture, one was pedunculated and the others had broad bases varying in size from a pea to a hazelnut. Diathermy was used with final disappearance. Patient has been under observation since, remains well and has had no recurrence in ten years.

Case IV. Female, age fifty-two years, was admitted March 13, 1917. He had been under treatment for diabetes and constipation. Six small adenomatous polyps were removed by guillotine from the rectum at the 4 inch level. In 1927, she returned with a history of rectal bleeding. An adenocarcinoma which was confirmed by biopsy, was located 3 inches above sphincter. It was irregularly nodular, 2 × 3 inches projecting an inch above the mucosa. It was destroyed by diathermy by intermittent sparkings lasting six weeks. Patient has been under observation since, remains well and has had no recurrence in eight years.

Case v. Male, age fifty-four years, was admitted November 1918 giving a history of loss of twenty-five pounds in weight, pain and tenesmus. Proctosigmoidoscopy revealed a large adenocarcinoma which almost fills the entire ampulla. Operation December 14, 1918, by Dr. H. G. Mudd, who did a Kraske and a permanent colostomy. In October, 1919, there was a large nodular recurrence of growth about anal scar. Dr. J. S. Kimbrough introduced a tube containing 75 mg. of radium leaving it in for twelve hours. A large slough followed with final healing. The patient has been under observation since with no recurrence after sixteen years.

DISCUSSION

Great progress has been made in the last decade in the diagnosis and surgical management of carcinoma of the large bowel. In spite of these advances too many patients with malignant disease consult the surgeon when the lesion has become inoperable. The curability of cancer of the rectum and pelvic colon has been repeatedly demonstrated. Even a 25 per cent chance of "five year cure" is a better expectancy than usually obtained in cancer of the cervix. The premalignant polypoid lesions of the rectum are just as amenable to treatment by surgical diathermy as the premalignant lesion of the cervix. It has been shown that the mortality and morbidity in the radical surgical treatment of cancer of the rectum in experienced hands is no greater than that admittedly justified in surgical procedures for cancer of the uterus. Despite these facts many physicians are reluctant to advise colostomy and radical removal of malignant lesions of the rectum and lower colon. The profession must be made "cancer-conscious," to be continually alert to the possibility and probability of cancer existing in apparently healthy individuals who suffer from seemingly minor symptoms. While this series of cases is comparatively small, the fact that 37 per cent are alive and well five years or more after resection lends distinct encouragement in prognosis. Eternal vigilance is the price of success in curing cancer of the rectum and pelvic colon.

SUMMARY

1. Routine proctosigmoidoscopy is recommended as part of every complete physical examination.

2. The necessity of careful, skillful fluoroscopic examination of the pelvic colon is emphasized in the early diagnosis of malignant lesions.

3. A series of surgically treated cases of cancer of the rectum and pelvic colon is presented with tables showing end results.

4. Individual case reports demonstrating the curability of cancer are recorded.

5. The value of surgical diathermy in the management of precancerous and cancerous lesions of the rectum and pelvic colon is emphasized.

REFERENCES

1. Soper, H. W. Sigmoidoscopy. *International Clinics*, Vol. 14, Series 26.
2. Soper, H. W. Polyposis of the Colon. *Am. Jour. Med. Sc.*, Vol. cli: No. 3, 405 (March) 1916.
3. Soper, H. W. Diathermy of the rectum and pelvic colon. *Jour. Mo. St. Med. Assn.*, p. 263–265 (June) 1930.
4. Miles, W. E. The radical abdomino-perineal operations for cancer of the rectum and pelvic colon. *Brit. Med. Jour.*, 2: 941–943 (Oct. 1) 1910.
5. Rankin, F. W. Colostomy and posterior resection for carcinoma of rectum. *J. A. M. A.*, 89: 1961–1966 (Dec. 3) 1921.
6. Lahey, F. H. Method of two stage abdomino-sacral removal of cancer of rectum. *New England J. Med.*, 204: 1279–1282 (June 18) 1931.
7. Coffey, R. C. Cancer of the rectum and recto-sigmoid. *Am. Jour. Surg.*, 14: 161–214 (Oct.) 1931.
8. Bartlett, Willard. One stage combined resection of the rectum. *Arch. Surg.*, 22: 786–793 (May) 1931.
9. Sistrunk, W. E. Advantages of low median line incision in exploratory laparotomy for carcinoma of rectum and recto-sigmoid. *Am. J. Surg.*, 85: 732–734 (May) 1927.
10. David, V. C. In Dean Lewis, Practice of Surgery. Vol. III, Chapter 6.
11. Dixon, C. F. Carcinoma of rectum. *Southwestern Med.*, 17: 370–374 (Nov.) 1933.
12. Morrison-Balfour. Tube resection in Dean Lewis, Practice of Surgery. Vol. VII, Chap. 6, Page 107.
13. Bargen, J. A. Vaccination against peritonitis in surgery of the colon. *Arch. Surg.*, 22: 98–105 (Jan.) 1931.

REPAIR OF CERTAIN TYPE OF HERNIA

HERNIAL SAC USED AS SUTURE MATERIAL

CHESTER L. DAVIDSON, M.D., F.A.C.S.

JAMAICA, N. Y.

FOR years surgeons have attacked the problem of the cure of inguinal hernia. This was first done by obliteration of the sac with cautery or carbolic acid, in the belief that this was the only necessary procedure to effect a cure. Then, removal of the sac was advocated. Later, it was ascertained that the repair of the floor of the inguinal canal was essential. Today these procedures form the basis of the Bassini operation. Astley Cooper[1] in his treatise on hernia in 1804, described hernia in a light that was to be acceptable to later work. In searching through the literature I have found only one reference to the use of hernial sac in the manner which is here described. In 1930 Brown[3] first described a method similar to the one used in this paper.

In a city hospital with a large and active surgical service a type of hernia is frequently found in which the ordinary repair will be ineffective. This hernia usually requires a fascia lata repair by the Gallie method[2] or some modification of it. Accompanying this type of hernia there is usually a large external opening and a marked weakening of the inguinal floor. In several of these cases a very large and markedly thickened sac extended into the scrotum. The application of this particular kind of hernial sac as suture material in the manner of a fascia lata repair has been studied. Studies of the microscopic sections of these hernial sacs convinced us that there were enough muscle fibers and elastic fibers and no round cell infiltration to make this material suitable for suture. (Figs. 1 and 2.) Estimations of its tensile strength compared favorably with commercial ox fascia. In this comparison fresh hernial sac tissue without any hardening or preservative was used.

INDICATIONS

The one requirement for this procedure is that the hernial sac must be of sufficient thickness and size to give length and strength to the suture material. The minimum thickness of the sac used in these cases was 3 mm. It must be accentuated that a sac which is too thin will not produce a good result. Therefore, this repair is indicated when a large hernia is found that presents a sac of sufficient thickness and size, together with a marked weakness on the floor of the inguinal canal.

TECHNIQUE

The usual inguinal incision is made through the skin, subcutaneous tissue and the fascia of the external oblique muscle, exposing the cremaster muscle and the spermatic cord. The hernial sac is then dissected from below upward and resected at the internal inguinal ring. The stump of the hernial sac is ligated with a suture ligature of No. 2 chromic catgut and tied. The stump is transplanted under the internal oblique muscle with one interrupted No. 2 chromic catgut suture. (Fig. 3.) The sac which has previously been amputated is now cut circularly from the top to the bottom, giving a strip of suture material ⅜ of an inch wide, as shown in Figure 4-1. This strip of fascia like material is then threaded into a thin fascia needle and is interlaced between the internal oblique muscle and Poupart's ligament, as close as possible to the pubic bone in the conjoined tendon. (Fig. 5.) As this interlacing is being done, a No. 2 chromic catgut

* From Department of Surgery, Cumberland Hospital, Brooklyn, N. Y.

suture is placed at every crossing of the suture material to prevent any slipping. The ends of the suture material are then brought out through the fascia of the external oblique muscle and sutured with an interrupted suture of No. 2 chromic is closed by using a No. 2 chromic catgut interrupted suture for the fascia of the external oblique muscle. (Fig. 5.) The skin catgut. This interlacing and the internal oblique muscle forms a floor in the inguinal canal. The cord is replaced and the wound is united in the usual manner. A small piece of rubber tissue drain is then inserted in the lower angle of the wound where it remains for forty-eight hours.

When the hernial sac is to be used as suture material and also as a graft over the interlacing sutures, the sac is bisected from its bottom upward to the internal inguinal ring, leaving the posterior half attached to the ligated stump. The anterior half is then used as suture material. The method of cutting is shown in Figure 4 *a* and *b*.



Fig. 1.

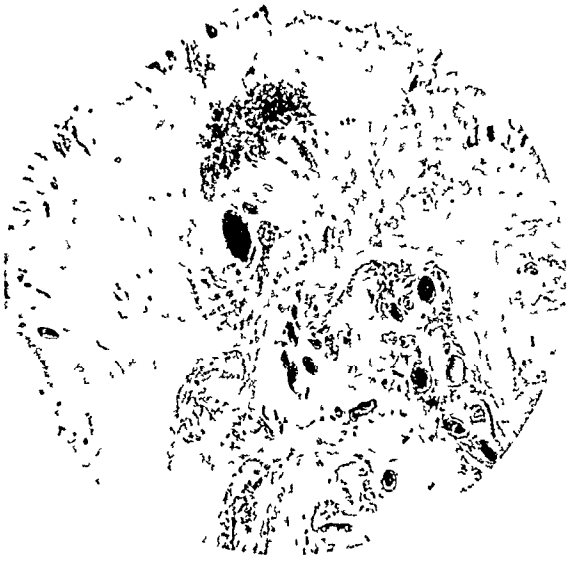


Fig. 2.

Microscopic cross section of hernial sac showing muscle fibres, blood vessels, connective tissue fibres but no round cell infiltration.

REPORT OF CASES

This procedure has been followed in 13 cases with complete success in 12 and partial success in one, two or more years postoperative. All were males and there were no deaths. In the one case of partial recurrence, it was thought that the error was made in not placing the suture close enough to the pubic bone. There were two superficial infections, both Staphylococcus albus in origin.

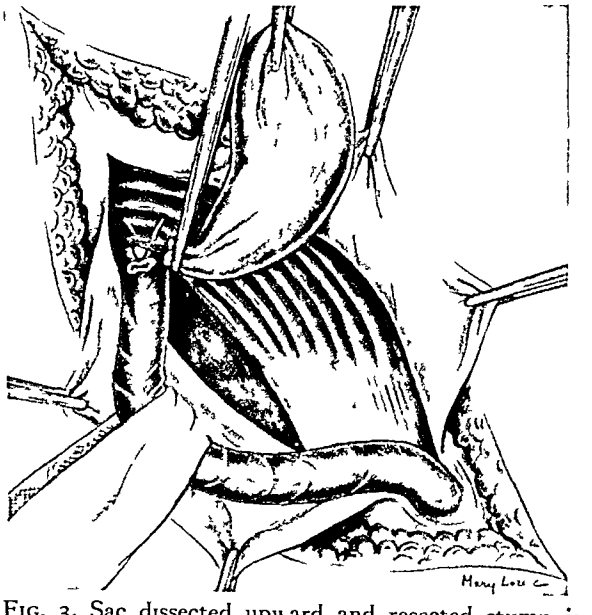


Fig. 3. Sac dissected upward and resected stump is transfixed.

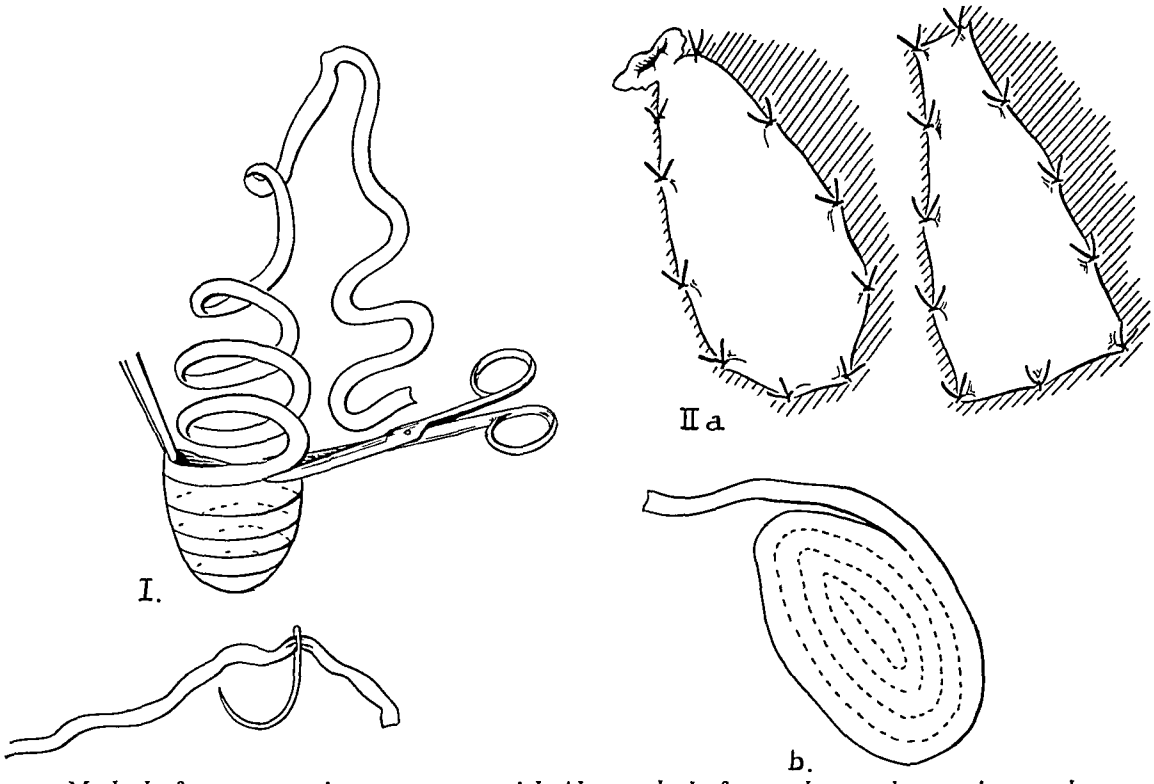


FIG. 4. Method of cutting sac into suture material. Also method of transplant with posterior attachment to stump and without attachment to stump.

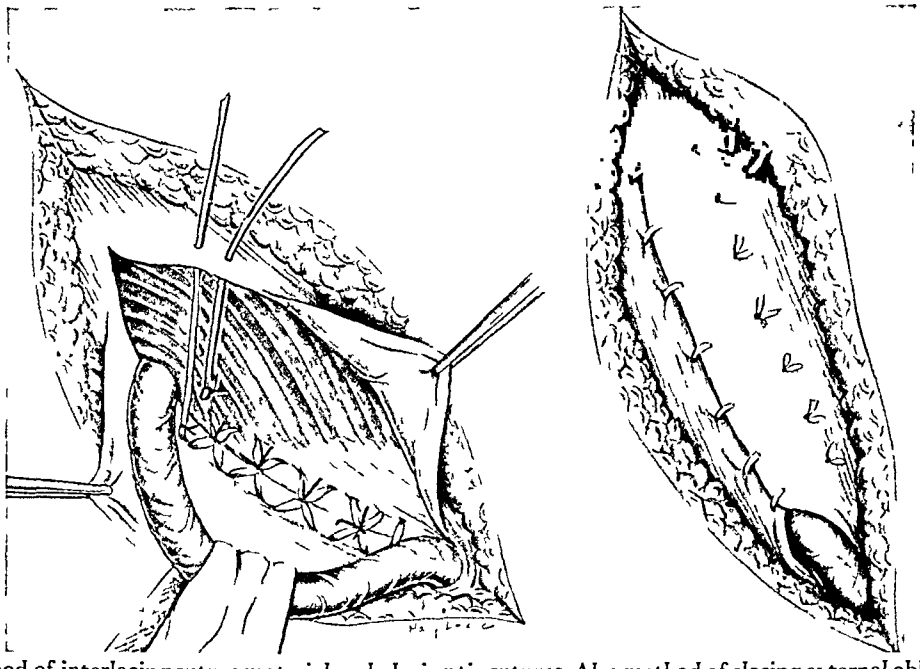


FIG. 5. Method of interlacing suture material and placing tie sutures. Also method of closing external oblique fascia.

COMMENT

It must be borne in mind that the hernial sac which is to be used as suture material must be of the required thickness. Experience has taught that if the sac is too thin for use in this manner there will be a recurrence. It is believed that in the occasional case of this type when this described procedure is indicated it will be essentially successful, and it is easier and quicker to perform than the usual fascia lata transplant. Not all hernias which appear clinically to be the type for this manipulation will prove at operation to have a sac of sufficient thickness. The only means of determining a case that is applicable for the foregoing procedure is by a thorough examination of the sac at the time of the repair.

SUMMARY

A method for the repair of a certain type of inguinal hernia using the hernial sac as suture material has been described. There were 12 cases completely successful and one partially successful.

REFERENCES

1. Cooper, Astley. Anatomy and Surgical Treatment of Hernia. London, 1804.
2. Gallie, W. E. and Le Mesurier, A. B. The use of living suture in operative surgery. *Canad. M. Assn. Jour.*, 11: 504, 1921.
3. Brown, F. R. The use of strips of hernial sac as fascial (living) suture. *Br. Med. Jour.* 858, (May) 1930.
4. Neuhof, H. The Transplantation of Tissues. New York, Appleton Co. 1923.
5. Park, R. A new method of utilization of the sac in the radical cure of hernia. *Surg., Gynec. & Obst.*, 3: 329, 1906.
6. Lieschied, A. Radical plastic operation of large inguinal hernia using hernial sac. *Deutsche Ztschr. f. Chir.*, 190: 307–315, 1925.
7. Fusari, A. Reenforcement of wall of inguinal canal. *Arch. ital. di. chir.*, 14: 671–694, 1925.
8. Davis, G. G. On the treatment of the sac in operations for the radical cure of hernia. *Tr. Coll. Phys. Phila.*, 3. s., 17: 131–137, 1895. Also *Ann. Surg.*, Phila., 23: 32–37, 1896.

REFERENCES OF DR. SHARER*

1. Curtis, G. M. Intrathoracic goiter. *J. A. M. A.*, 98: 737 (Mar. 7) 1931.
2. Maclean, N. J. Intrathoracic goiter. *Minn. Med.*, 11: 286, 1928.
3. Morris: Human Anatomy.
4. Lahey, F. H. Intrathoracic goiter. *Surg. Gynec. and Obst.*, 59: 627, 1934.
5. Felberbaum, D. and Finesilver, B. Substernal thyroid. *Am. J. Med. Sc.*, 171: 218, 1926.
6. Pemberton, J. and Mahorner, H. Retrofascial intrathoracic goiter. *Surg. Clin. N. A.*, 11: 787, 1931.
7. Lazarus, J. and Rosenthal, A. Lateral aberrant thyroid glands. *Ann. Surg.*, 98: 1023, 1933.
8. Terry, W. I. Intrathoracic goiter. *Surg. Clin. N. A.*, 2: 489, 1922.
9. Pemberton, J. Surgery of substernal and thoracic goiters. *Arch. Surg.*, 2: 1, 1921.
10. Jackson. Quoted by Higgins.
11. Higgins, C. C. Intrathoracic goiter. *Arch. Surg.*, 15: 895, 1927.
12. Lamson, O. F. Intrathoracic goiter. *Surg. Gynec. and Obst.*, 27: 397, 1918.
13. Hubert, L. Substernal thyroid with bilateral laryngeal paralysis. *J. A. M. A.*, 80: 842 (March 24) 1923.
14. Pilcher, L. and Overholt, R. Venous obstruction in the upper mediastinum. *Ann. Surg.*, 100: 74, 1934.
15. Schwyzer, G. Diagnosis and surgical treatment of intrathoracic goiter. *J. A. M. A.*, 74: 597, 1920.
16. Bachford, B. K. Substernal thyroid with pressure symptoms. *Am. J. Med. Sc.*, 160: 410, 1920.
17. Rankin, F. Adenocarcinoma in a huge substernal adenomatous goiter. *Surg. Clin. N. A.*, 13: 927, 1933.
18. Wessler, H. and Jaches, L. Clinical Roentgenology of Diseases of the Chest. Southworth Pub. Co. 1923, p. 442.
19. Curtis, G. M. and Delaney, P. A. Cavernous hemangiectasia occurring within a nodular goiter. *Arch. Path.*, 10: 580, 1930.
20. Pfahler, G. Irradiation in the treatment of hyperthyroidism. *Radiology*, 18: 879, 1932.
21. Davies, H. X-ray treatment of some conditions of thyroid and thymus. *Brit. J. Radiology*, 7: 362, 1934.
22. Stevens, J. I. The roentgen rays and radium in toxic goiter and hyperthyroidism. *J. A. M. A.*, 97: 1689 (Dec. 5) 1931.

[*For remainder of references see p.* 107.]

* *Continued from p.* 62.

EPISIOTOMY UNDER LOCAL ANESTHESIA

SIDNEY VERNON, M.D.

WILLIMANTIC, CONN.

A PROCEDURE that lessens the danger or difficulty of childbirth and at the same time tends to lower the cost of medical care is worthy of serious consideration. The majority of labors, at home or at the hospital are attended by a single physician and a method that makes labor more efficient is bound to improve obstetric morbidity and mortality statistics.

The desirability of episiotomy is well known. The child's welfare is improved and the mother's strength is preserved by this operation whenever a rigid or disproportionate perineum is encountered. A clean cut wound is more easily and effectively repaired than a tear. The use of barbiturates sometimes makes voluntary efforts difficult or too feeble to be effective in getting the head over a resistant perineum. Episiotomy with low forceps then would be indicated. The increasing use of barbiturates in obstetrics will probably make such instances more frequent. With a single physician in attendance, the difficulty of obtaining a desirable anesthesia would cause withholding from doing an episiotomy where indicated. Where "prophylactic" forceps with episiotomy is practiced, barbital narcosis with local anesthesia might be sufficient for the procedure and thus the patient avoids the disadvantages of general anesthesia. Where chloroform or ether is used for such work the toxicity and postanesthetic discomfort are decidedly detrimental. Delay of postpartum contraction and retraction of the uterus caused by general anesthesia with consequent danger of hemorrhage is obviated by the use of local anesthesia.

Technique. The mediolateral incision is used. Using a hypodermic needle, and 1 per cent procaine, a bleb is raised in the skin at the edge of the vulva near the fourchette, preferably at the time the fetal head causes bulging of the perineum. A 20 gauge 2 inch needle is then placed on the syringe and the needle directed laterally and downward, injecting as it is advanced and drawn back to the skin. The needle is again advanced along the vaginal wall, with a finger in the vagina to guide the needle and prevent piercing the vaginal mucosa. Incision is made by a series of scissor cuts so as to judge accurately the depth of incision along the skin and the mucosa. Bleeding is controlled by clamp and ligature. The fetal head is delivered by encouraging voluntary efforts during a pain, Kristeller expression or the use of low forceps. A Beck binder to make voluntary efforts more efficient is of advantage.

While awaiting separation of the placenta, the sutures are placed using No. 2 chromic catgut. After the delivery of the placenta the sutures are tied and silkworm gut is used to approximate the skin. The silkworm sutures are placed deeply and then tied without tension.

No deformity of the perineum after healing was noted when the mediolateral incision was used. It is superior to median episiotomy as the anal sphincter is not needlessly exposed to damage.

Comment. The use of local anesthesia for episiotomy is advised and described. It increases safety and decreases expense of accouchement. By removing the obstacles of anesthesia the application of episiotomy is simplified for the general practitioner delivering a mother in the home. An easier application of a valuable procedure and a consequent wider practice of perineal suture should improve the practice of obstetrics.

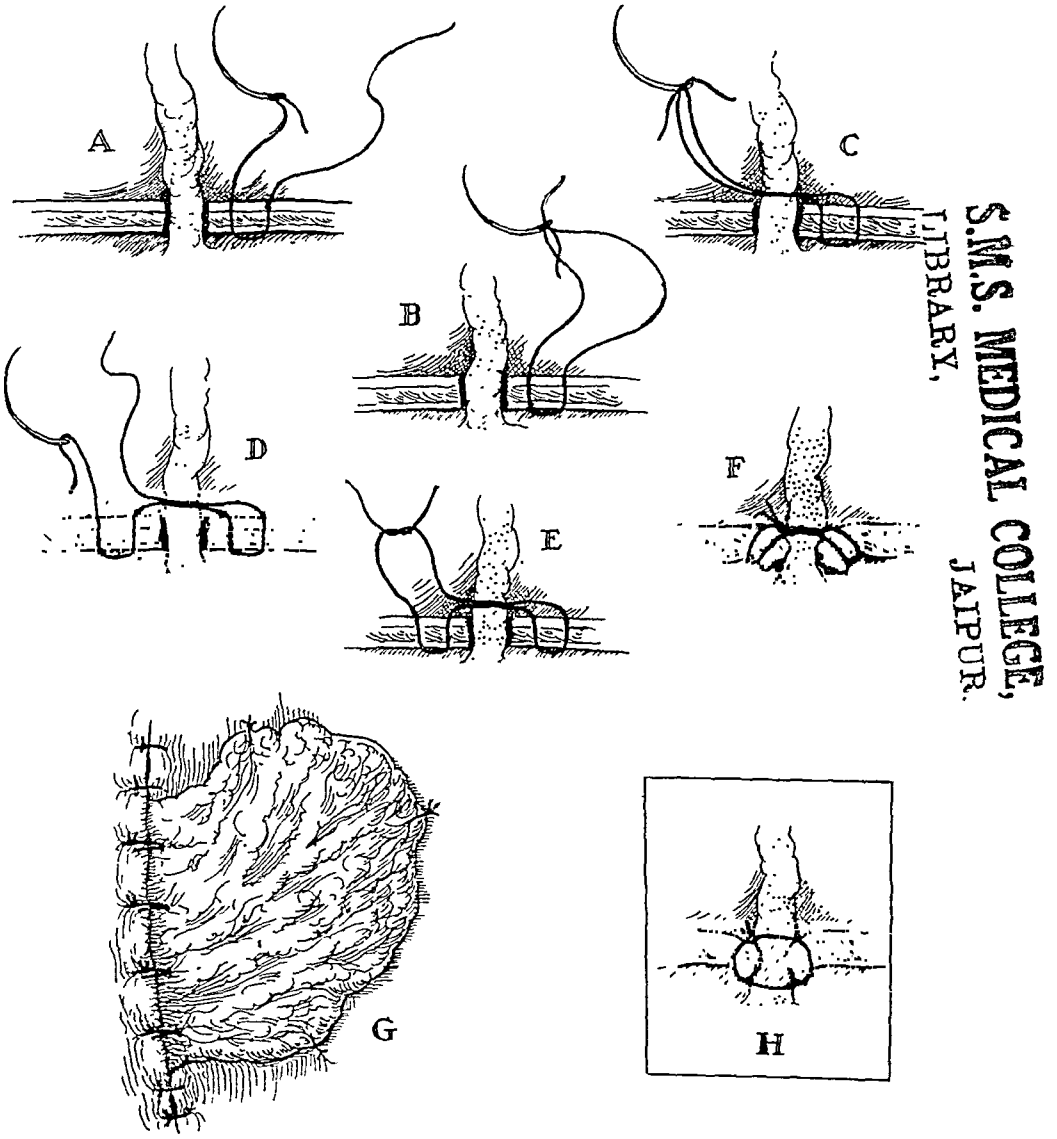
PERITONEAL SUTURES IN NARATH AND SCHÖNBAUER'S MODIFICATION OF TALMA'S OPERATION

GUSTAV ZECHEL, M.D., F.A.C.S.

Assistant Professor of Anatomy and Associate in Surgery, College of Medicine, University of Illinois

CHICAGO, ILLINOIS

THE critical point in Narath and Schönbauer's modification of Talma's operation is the complete closure of the peritoneum in spite of the permanent protrusion of a part of the mesentery, its new location becoming the space between the posterior wall of the rectus sheath and the rectus muscle, or between the rectus sheath and the subcutaneous tissue. The purpose of this permanent eventration of the lower end of the mesentery and its fixation in a new position is the formation



S.M.S. MEDICAL COLLEGE, JAIPUR. LIBRARY,

of adhesions and subsequently the gradual establishment of a collateral circulation; portal vein, gastric or gastrio-epiploic veins, omental veins, the superior epigastric vein to the internal mammary and the subclavian vein or superficial epigastric vein to the femoral vein. This relieves the stasis in the portal system and prevents the accumulation of new ascitic fluid in the peritoneal cavity caused by cirrhosis of the liver. The peritoneum is closed by the usual method first above and then below the extent of the omentum (two upper and two lower sutures in Fig. G). The omentum, in passing through the peritoneal incision, is then spread out so that it lies as a flat sheet in the peritoneal slit and not as a crowded mass, which would prevent a close adaptation of the peritoneal margins. The sutures uniting the margins of the peritoneal wound in the line of the omental protrusion have to go through the omentum, which can be accomplished by different methods. If the suture is guided through one margin of the peritoneum, then through the protruding omentum, and finally through the other peritoneal margin, the ligature must be tightened around the mesentery as far as it protrudes. This represents a very crude method disturbing the circulation of the explanted part of the mesentery and should not be recommended, since the preservation of the circulation in the omentum must be the main purpose of the entire procedure. A better way would be the double threading through the omentum at two different points as shown in Fig. H, but this obviously endangers the viability of the piece of omentum encompassed by the suture and often causes its sloughing, and secondarily a gap in the peritoneum which is to be prevented because of the danger of herniation. Furthermore, if a necrosis should develop, there is also the danger of thrombosis of some vessels of the mesentery passing through the incision. Since the successful result of the operation depends upon the preservation of the circulation in the mesentery, this complication means a partial or total failure of the procedure.

Therefore, as a prophylactic measure, the following method is recommended. A mattress suture is applied through one margin of the peritoneum, and the posterior wall of the rectus sheath, as indicated in Fig. A. The free end is threaded again through the needle as illustrated in Fig. B, and the needle is carried through the omentum (Fig. C). Since both ends are threaded through the needle they both go through a common channel in the omentum. The longer end is again taken from the needle eye, and the next mattress suture is made with the single thread lateral to the other margin of the peritoneal wound, (Fig. D). The needle is then taken off, and both ends of the thread are ready for ligation (Figs. E and F). As both ends go through the same channel, the ligature can be made as tight as necessary without any danger of disturbing the circulation of the omentum (Figs. F and G), thus insuring the close adaptation of the sutured structures without danger of necrosis, as explained by the comparison of Figs. F and H.

PODALIC VERSION

SAMUEL S. ROSENFELD, M.D., F.A.C.S.

NEW YORK

PODALIC version is one of the most important and efficient procedures in obstetrics, saving the parturient many hours of labor, and from lacerations and complications consequent on the application of forceps. In cases of justo minor pelvis, the obstetrician frequently obviates the necessity for cesarean section by a podalic version. Despite its inestimable value and the skill which many have acquired in performing it, I believe that the procedure has very definite indications and limitations.

Potter popularized and rejuvenated this ancient procedure, reporting on a large series and incorporated the good points of many other techniques with his own.

The following tables show the parity, indications, mortality and complications in a series of 120 consecutive cases of podalic version.

TABLE I

Para 0	Para 1	Para 2	Para 3	Para 4	Para 7
81	20	14	3	1	1

TABLE II

INDICATIONS

Contracted pelvis	63
Large baby	22
Head unengaged	8
Twins (usually the second baby)	10
R.O.P.	21
L.O.P.	7
R.M.P.	1
Transverse	3
Prolapsed cord	5
Maternal fatigue	3
Forceps unsuccessful prior to version	21

In many cases a few of the indications were simultaneously present.

TABLE III

Maternal mortality	0
Gross fetal mortality	11

Two of the fetal deaths occurred before the onset of labor; one was due to hydrocephalus, and the other was a macerated fetus, the cause of whose death was undetermined. Five infants died during labor before delivery. Three died either in the process of delivery or within a short time thereafter. The resumé of these three cases is as follows:

CASE I. This occured in a nullipara with a contracted pelvis. The baby was fairly large and the umbilical cord short. The cord tore before the shoulders could be delivered, though this was accomplished after only a short delay. The head was easily delivered. The baby lived about a half-hour and death was probably due to asphyxia. Autopsy was unobtainable. This woman was subsequently delivered of a living baby by cesarean section.

CASE II. This occured in a para seven with a contracted pelvis. The cord was prolapsed. The baby weighed over nine pounds. She had had similar experiences in some of her previous labors.

CASE III. This occured in a para three. The cord was prolapsed, the baby large, and the arms extended.

One fetal death occurred one week after delivery. Autopsy revealed massive hemorrhage into the adrenals, and hemorrhages from the mouth and the intestines. The pathologist, Dr. Joseph C. Ehrlich, considered this a case of adrenal apoplexy.

The gross fetal mortality in this series was 9.1 per cent; after deducting the deaths that occurred before delivery it was 3.3 per cent. The case of adrenal apoplexy was not deducted from the gross mortality because the etiology of this condition is still in doubt. Some pediatricians consider the cause to be trauma while others believe it to be infection. This child had fever and would tend to bolster the infectious theory of this disease. The mother of this child was subsequently delivered per vaginam of a normal baby.

TABLE IV

COMPLICATIONS

Maternal: Third degree tears	3
These were immediately repaired and all three women made perfect and uneventful recoveries.	
Fetal:—Fracture of humerus	1
Fracture of clavicle	1
Fracture of tibia	1
Erb's palsy	1
The fractures occurred in babies weighing between 8½ and 9½ pounds; all recovered. After prolonged orthopedic treatment the case of Erb's palsy now has satisfactory muscular development and function.	

DISCUSSION

Potter's technique is followed closely.

Though a lateral episiotomy is performed in most of the cases, especially in nullipara, the perineum is "ironed out" as this stretches and softens the tissues so that subsequent manipulations are facilitated.

Both shoulders are delivered anteriorly, no difficulty being encountered in the majority of cases. Occasionally when the anterior shoulder will not engage beneath the symphysis, it is preferable to rotate the child and permit the opposite shoulder to engage and deliver it anteriorly. In a few instances it was found necessary or easier to deliver one shoulder posteriorly.

Recently I have resorted to applying forceps to the aftercoming head, thereby saving several babies. The forceps traction is not as injurious to the fetal spine as is the traumatizing pull on the head that is "stuck."

In the cases of twins I find it expedient to deliver the second child by podalic version immediately after the birth of the first. Where intervention is necessary, the first child is usually delivered by forceps. In a few instances both children have been delivered by version. I do not advocate routine version delivery of both children because there is rarely sufficient space for the first fetus to make the elliptical excursion necessary in version. This lack of space frequently results in trauma and death to the first child.

Since many versions are performed because of disproportion, the greatest measure of success will come to the obstetrician who can choose the proper case for a version. I never attempt to perform a version where the disproportion is great, but I have delivered babies weighing more than ten pounds by this method. Patients with absolute disproportion I deliver by caeserean section.

In cases where pelvic delivery is possible and version may fail, I prefer to try to deliver first by forceps, for if forceps fail version can still be done.

In many cases of posterior or transverse occipital presentations I prefer version to the usual double maneuver necessary when forceps are applied.

SUMMARY

One hundred twenty babies were delivered by podalic version, employing the Potter technique. There was a real indication for version in every case.

There was a corrected mortality of 3.3 per cent and had one case of adrenal apoplexy also been deducted, which probably would have been justifiable, the mortality percentage would have been 2.5 per cent, not much higher than in a series of normal deliveries.

CONCLUSION

Given fine obstetrical judgment, podalic version is an ideal method of procedure for the lesser degrees and in some cases even of moderate degrees of pelvic contractions or disproportions. It is also of great value in malposition such as posterior occiput, transverse and face positions.

The Potter technique is the preferred method to employ in the performance of version.

In cases where difficulty is experienced in the delivery of the aftercoming head, forceps should be applied more often.

CASE REPORTS

FATALITIES IN PHRENIC NERVE SURGERY

EDWIN J. GRACE, M.D., F.A.C.S. AND EDWARD H. LINNEHAN, M.D.

Assistant Attending Surgeon, Kings County Hospital; Associate Attending Surgeon, St. Mary's Hospital

Resident Surgeon, Kings County Hospital

BROOKLYN

IN their recent publications on surgical diseases of the chest, Graham, Singer and Ballow have shown that this operative procedure is not entirely free from serious consequences. Berry in 1930 summarized 4697 cases of reported phrenic nerve operations in pulmonary tuberculosis found the mortality rate in this group was 0.5 per cent.

Since starting this work in 1930, we have done 150 cases of phrenic nerve operations, two-thirds had the nerve avulsed and one-third a crushing procedure producing a temporary hemi-diaphragmatic paralysis; 100 patients were operated for pulmonary tuberculosis and the remaining 50 for other forms of chronic pulmonary pathology.

If we group our cases we have a mortality rate of 0 in the tuberculous group, but in the non-tuberculous group it is 4 per cent. These fatalities are reviewed.

CASE 1. Patient, A. G., age thirty-two, was admitted to the medical service on January 28, 1934.

His father and mother had died of pneumonia.

The patient gave a history of chronic bronchitis since seven years of age and had had pneumonia five times. For the past fourteen years he had had a severe cough with pain in the chest, dyspnea on exertion, and has been raising an abundance of greenish yellow foul smelling sputum. Patient has been unable to work for several years.

The expansion of the chest was limited, but equal on both sides. Impaired resonance and moist rales were heard over upper half of both chests posteriorly, with medium crepitant rales over the upper third of left chest anteriorly. Loud moist rales were heard over both chests anteriorly.

Bilateral bronchiectasis was diagnosed, with tuberculosis to be ruled out. Repeated sputum examinations were negative for tuberculosis.

On bronchoscopy February 15, 1934 one ounce of mucopus was aspirated from right and left lower lobes.

March 2, 1934—Lipiodal *x*-ray showed evidence of marked bronchiectasis in the right and left cardio phrenic angles, more pronounced in the right side. The bronchiectases are of the saccular and cylindrical types, i.e., of the saccular type on the right side and of the cylindrical type on the left side.

The blood Wassermann was negative, the other laboratory findings were normal.

On March 8, 1934 under local anesthetic, the phrenic nerve on the left side was identified as it crossed the left anterior scalene muscle. It was frozen for about one minute with ethyl chloride. No further procedure was done.

The patient's condition was fair for the first few hours following operation. The foot of the bed was elevated slightly. The respirations were somewhat labored and atropine gr. $\frac{1}{150}$ was given by hypodermic.

March 9, 1934 the patient's condition became critical about 1:00 A.M. His respirations were embarrassed and very edematous; atropine and caffein were given to him. The blocks taken from the foot of the bed, and the patient put in Fowler's position. At 2:00 A.M. his condition was somewhat improved; he slept until 3:30 A.M., when he became much worse, respirations embarrassed, very edematous, unable to cough and raise sputum. He improved somewhat in an oxygen tent. At 4:30 A.M. his con-

dition became worse again. Moist mucous rales were heard throughout both lungs. The patient was unable to raise mucous.

One hour later the patient was moribund. Caffein and atropine were given to him. There was marked edema of both lungs. The patient was unable to raise any sputum, practically drowning in his own mucous. Fifteen minutes later he expired in spite of oxygen therapy and all forms of stimulation.

We have definitely learned that a phrenic operation in severe or moderately severe bronchiectases with unilateral or bilateral involvement is definitely harmful, *as in our opinion, this case illustrates.*

In his original report of phrenic paralysis Sauerbrack gave bronchiectasis as a condition helped by this operation, but no mention is made of the extent or degree of the bronchiectasis. It is possible that in mild forms this operation may be helpful.

Case II. T. M., white, male, forty years of age, was admitted March 11, 1935 to the Medical Service complaining of persistent cough and large amounts of foul-smelling sputum of six months duration; dyspnea on moderate exertion and loss of fifteen to twenty pounds in past two months.

Past History. Toe amputated several years ago. G.C. and chancre. Admitted in 1917.

Examination shows evidence of recent loss of weight. Showers of fine rales were heard throughout both apices. Percussion in these areas produced flatness. Sputum on several occasions was negative for tuberculosis.

The blood Wassermann was negative.

X-ray of the chest was negative for tuberculosis, but showed an area of increased transparency in right lower lung field due either to an unresolved pneumonic process or a lung abscess.

Two weeks later there was a localized area of destruction in right lower lung field suggestive of a lung abscess.

On March 22, 1935 the lung abscess was located by *x*-ray and fluoroscope in region of the fifth and sixth ribs anteriorly and seventh and eighth posteriorly.

April 5, 1935. Lung fixation was done under cyclo-propane anesthesia. Two strips of iodoform gauze were packed under the seventh and eighth ribs posteriorly and anteriorly under fifth and sixth ribs and patient returned to ward in fair condition.

Patient did fairly well for next few days though the respirations were somewhat labored.

One pack was removed on the fourth postoperative day.

On the sixth day the sutures and the remaining pack were removed. The general condition was good and the sputum was less in amount.

One week after the lung fixation, the right phrenic nerve was crushed for 0.5 cm. and patient returned to the ward in good condition.

The following day the condition was only fair; he was very dyspnoeic and perspiring profusely. He gave a history of an old asthmatic condition.

April 14, 1935. He was weak and dyspnoeic. Rales were heard in the chest characteristic of asthma. Long, loud expiratory grunts and wheezings were heard all over the back and lungs. Atropine and adrenaline was given to the patient and he was kept on continuous oxygen with little relief. Patient was unable to raise any mucous though there was marked edema of the lungs. Respirations were noisy. Patient had difficulty in breathing.

April 16, 1935. Condition was much worse; patient is dyspnoeic and somewhat cyanotic. Respirations were embarrassed and crackling rales were heard throughout the chest. Patient was unable to raise mucous except with great effort.

April 16, 1935. 12:40 P.M. The patient expired in spite of all forms of stimulation and continuous oxygen therapy.

In our opinion, these 2 deaths in this nontuberculous group are attributable to various causes, namely:

(1) A lack of specific data as to the end results in this group composed of lung abscesses, bronchiectases and chronic empyema (non-tuberculous);

(2) The wide divergence of opinion as to the value of phrenic operations in those with chronic non-tuberculous forms of pulmonary pathology and

(3) The great variation in the nature and extent of the pathology.

If we use this as a workable plan, the case of severe bilateral bronchiectasis must definitely be accepted as inoperable, with

our present surgical knowledge. Early mild cases might occasionally be helped.

One of us, (E. G.), felt that some partial relief could be obtained by phrenic nerve operation.

Overholt in 1932 reported beneficial results obtained by fixation of the lung at a point just above the upper limit of the abscess, followed by a temporary hemidiaphragmatic paralysis. This procedure was followed in Case 11. The first stage was not associated with reaction but eighteen hours after the phrenic operation dyspnea started and continued until his death. This breathing was typically asthmatic, but no treatment was beneficial. I feel that the operative procedure was responsible for precipitating this pulmonary calamity.

In reviewing our operative mortality in this series of 150 phrenic nerve operations, it will be noted that in the cases of pulmonary tuberculosis there were no deaths. It is in this group that this operation unquestionably does its greatest good. With any method producing such excellent results as it does in pulmonary tuberculosis, it is only logical that we pass through a developmental stage of chest surgery, trying to incorporate this procedure with other therapeutic means in non-tuberculous chest problems.

In the division of Thoracic Surgery at Kings County Hospital from which these deaths are reported, our experiences have shown that in the non-tuberculous group this surgical procedure has been discouraging except in an exceedingly small, selected group.

SUMMARY

After we had completed the reported series of phrenic nerve operations we were impressed with the exceptionally brilliant results that often followed the procedure in effecting cures in many protracted cases of pulmonary tuberculosis, in some cases thoracoplasty has been made unnecessary and in others extensive thoracoplasty has been definitely limited to the upper stages. In our experience there was ample data to prove the value of this operation in pulmonary tuberculosis.

The most instructive aspect of this study from a comparative point of view was the small number of non-tuberculous patients that were definitely helped by this operation. In our opinion we feel that unless a very critical attitude is assumed concerning the marked limitation of the operation in this later group, serious complications can readily develop.

REFERENCES OF DR. SHARER*

23. Guthrie, D. and Conklin, S. D. The preoperative preparation and the postoperative care of the patient with hyperthyroidism. *Internat. Clinics*, ser. 44; 3: 159, 1934.
24. Young, E. L. Jr. Case of intrathoracic goiter. *New Eng. J. Med.*, 207: 1185, 1932.
25. Colp, R. Substernal goiter; with acute dyspnea. *Ann. Surg.*, 97: 280, 1933.
26. Guthrie, D. The advantage of the primary superior polar attack in the removal of substernal thyroids. *Ann. Surg.*, 84: 251, 1926.
27. Guthrie, D. Temporary loss of voice following thyroidectomy. *J. A. M. A.*, 71: 715 (Aug. 31) 1918.
28. Cattell, R. Position of the trachea following removal of substernal goiter. *Surg. Clin. N. A.*, 12: 805, 1932.
29. Lemere, F. Innervation of the larynx. *Arch. Otolaryn.*, 18: 413, 1933.
30. Freedman, L. M. Treatment of angina pectoris and congestive heart failure by total ablation of the thyroid; importance of laryngoscopic examination as a means of preventing bilateral paralysis of vocal cords. *Arch. Otolaryn.*, 19: 383, 1934.

* *Continued from p. 99.*

PARTIAL GIGANTISM: OVERGROWTH AND ASYMMETRY OF BONES AND SKELETAL MUSCLE

HENRY BASCOM THOMAS, M.D.

Professor of Orthopedic Surgery, University of Illinois College of Medicine

CHICAGO

A SIX year old boy was admitted to the Orthopedic Service of the University of Illinois, College of Medicine, presenting a very unusual condition: overgrowth of the legs especially of the feet and toes, the left leg larger than the right; asymmetry of the head; a large hemangioma of the chest wall and another one in the left groin. Cases of congenital partial gigantism are not a frequent orthopedic observation and always create speculation as to the etiologic factor or factors related to the overgrowth of bone and soft parts. In reviewing the literature, involvement of both feet was noted in only one other case, a twelve year old girl, reported by Spreitzer. In both cases several operations were performed to bring the feet nearer to normal size to facilitate walking and make it possible to wear shoes so that the patient could associate with other children.

CASE REPORT

B. H., male, aged six, admitted, July 7, 1932.

Family History: The patient was the fourth in a family of six children; all the others appearing normal and healthy. Two preceding generations both paternal and maternal, revealed no history of deformity, tumor, nervous disease, or syphilis.

Personal History: The child was born at term after a laborious and prolonged delivery due to the presence of a large tumor in the left axilla. At birth a large tumor was found on the left thoracic wall near the axilla, a smaller one in the left groin, a considerably enlarged left foot with the second and third toes and the great and second toes on the right. As the boy grew the hypertrophy of the foot and the toes increased proportionately, rendering shoe wearing impossible. He never complained of pain, but was very awkward in walking, and hence avoided playing with other children.

Physical Examination: The patient was a poorly nourished, white boy who walked with a peculiar gait on account of the abnormity of the feet.

Head: The right side was notably larger than the left. The head measured 49 cm.; the right half 25.5 cm. and the left half 23.5 cm., from the glabella to the occiput. The right ear was 3 cm. more anterior than the left. *Eyes:* There was a convergent strabismus on the right, associated with far sightedness and astigmatism. *Eye grounds* were negative. *Nose and Ears* do not show any pathology. *Mouth* presented many carious deciduous teeth. *Throat and Thyroid Gland* were normal.

Chest: An extra thoracic soft tumerous mass measuring 14 × 26 × 5 cm. was situated on the left side.* Otherwise examination apparently negative.

Abdomen: Veins were very prominent. A soft tumor in the left groin measured 10 × 5 cm.

Upper Extremities presented no appreciable anomaly. The right forearm and arm were 0.5 cm. larger than the left.

Lower Extremities: The left limb was larger than the right, although both showed overdevelopment of the muscles. The circumference of the left thigh was 28 cm., and the right 25.5 cm.; the left calf 22.5 cm. and the right 17.5 cm. *Left Foot:* The length of the sole, from the heel to the tip of the great toe, 22.5 cm. on the left, and 20 cm. on the right. The anterior portion of the left foot was 7 cm. long and 6.25 cm. wide; of the right foot, 5.5 cm. long and 5 cm. wide.

Evidently the hypertrophy of the toes involved both the length and the width of the bones, most striking in the metatarsal and phalangeal epiphyses. The deformed toes showed the average range of motion except the

* A detailed description of the two tumors, found to be hemolymphangiomas and the treatment by surgery and radiation is not within the scope of this article and was the subject of another publication. AM. JOUR. SURG. 31: 354, Feb. 1936.

Left Toes:
The great toe —3.25 × 2 cms.; circumference —5.75 cm.
The second toe—6.5 × 3.25 cms.; circumference—9 cm.
The third toe —5.75 × 3 cms.; circumference —8.5 cm.
The fourth toe—3 × 1.33 cms.; circumference —3.5 cm.
The fifth toe —3 × 1.33 cms.; circumference —4 cm.
Right Toes:
The great toe —5 × 3.25 cms.; circumference —9 cm.
The second toe—4.5 × 2.5 cms.; circumference —7 cm.
The third toe —3 × 1.33 cms.; circumference —4 cm.
The fourth toe—3 × 1.1 cms.; circumference —3.5 cm
The fifth toe —3 × 1 cms.; circumference —3 5 cm.

plantar flexion of the last phalanges, which were held in slight hyperextension due to excessive growth of the articular ends. Adipose masses were present on the plantar surface of both feet, the left extended from the bases of the second and third metatarsals covering these two bones and the adjacent toes; on the right it covered about two-thirds of the first and a half of the second metatarsal bones, the great, the second and the third toes. There seemed to be thinning of the overlying skin which was white, cool and slightly shiny. Nails of the hypertrophied toes were normal, and they did not grow faster than the others.

Genitalia: There were dilated and tortuous veins in the scrotum.

The right testicle, in the scrotum, was of normal size and consistency.

The left undescended testicle appeared to contain cysts filled with a clear fluid.

Reflexes were normal.

Sensibility of the hypertrophied parts: tactile, temperature, pain and pressure was normal.

Blood and urine examinations showed no pathology.

Kahn test was negative.

X-ray films revealed developmental anomaly of structure of the involved metatarsals and phalanges, especially their epiphyses, in length and thickness.

The patient was slightly below average intelligence with quotient of approximately 83.

OPERATIVE PROCEDURES USED FOR CORRECTION OF FOOT AND TOES DEFORMITY

Disarticulation of the right second toe at the base of the second phalanx was done Feb. 6, 1933. Removal of the distal phalanx of the right great toe and disarticulation of the left second toe was performed April 24.

Operative Findings. Left second toe: In place of the normal medial and lateral arteries there were three additional moderately sized arteries in the areolar tissue of the plantar surface of the toe, and another smaller artery in the middle of the dorsal areolar tissue.

Plastic operation on the left foot, July 5. The third toe was disarticulated at the metatarsophalangeal joint, and the head of the third



Fig. 1. (A) Plantar view of feet before operation. (B) Showing amputation of two large toes and plastic repair on the left foot and partial amputation of the two large toes on the right foot.

metatarsal was removed together with the epiphysis. The second and the third metatarsal bones were filed smooth. A large vascular pad of fat with the overlying skin was removed from the plantar surface by a wedge shaped incision. Several large pads of fat had to be dissected from the plantar surface before the skin could be approximated.

Plastic operation of left foot, Feb. 5, 1934; resection of the second metatarsal and the

middle cuneiform bones. A longitudinal incision was made over the dorsum of the foot extending the length of the second metatarsal. Dissection was carried through the lymphoid tissue with excision of the entire second metatarsal and the middle cuneiform, resecting the excess tissue on the dorsum of the foot. The distal extremity of the incision was carried forward over the plantar surface in such a manner as to excise a wedge shaped mass of excessive tissue. Two deep retention sutures were placed approximating the remaining metatarsals.

Plastic on left foot, March 26. A curved incision with proximal base was made over the medial surface extending from the head of the first metatarsal posteriorly to the junction of the astragalus and the os calcis. Dissection was carried through the subcutaneous tissue, and the mass causing the bulge on the internal and inferior surface of the foot was found to be hypertrophied muscular bellies of the short flexor and adductor of the great toe. The lymphatic tissue that was present over the dorsum of the foot was not encountered in this region. The two muscles were dissected free from the adjacent tissue and excised. The tendons were anchored. Deep sutures were placed to obliterate the dead spaces, and the incision was closed in the usual manner.

Whirlpool was used daily for the left foot for about three weeks. The patient who weighed forty-eight pounds in 1932, gained eleven and one-half pounds in the year and a half. Smaller shoes were ordered.

SURGICAL RESULT

Measurements taken after the interventions.

Right	*Left*
Length of the sole—20 cm.	20 cm.
Length of the instep—13.75 cm.	13.125 cm.
Width over the base of toes—10.25 cm.	10.1 cm.
Circumference around base of toes—20 cm.	19 cm.
Circumference around ankle—18.125 cm.	18.75 cm.

Right	*Left*
Length of great toe—3.75 cm.	Hypertrophied 2nd & 3rd toes were entirely removed.
Length of 2nd toe—3.75 cm.	
Circumference of great toe around the base—8.75 cm.	
Circumference of great toe around the top—6.25 cm.	
Circumference of 2nd toe around the base—6.375 cm.	
Circumference of 2nd toe around the top—6.375 cm.	

PATHOLOGICAL REPORT

Specimen of Bone from Left and Right Foot. Microscopic: The bony trabecula are prominent and rather thin. The medulla is practically replaced by fat tissue. The periosteum appears to be somewhat thickened with active bone formation. These changes, that is, osteoporosis, fatty degeneration of the bone marrow and osteogenesis, appear to be essentially developmental in character.

Specimen of Hypertrophic Muscle.

Gross: Specimen consists of several irregular pieces of muscle tissue. The individual muscle fibers are quite thick in diameter.

Microscopic: This is a section of striated muscle displaying profound changes irregularly distributed and primarily involving the stroma. The muscle bundles are variable in size, some of them quite large with numerous degenerative changes, as exemplified by the presence of muscle giant cells, swelling and granular changes in cytoplasm and loss of nuclei. The stroma displays a patchy proliferation in which numerous fibroblasts and occasional round cells are seen, all with replacement of normal muscle fibers. What is apparently an earlier stage of the same process is found scattered through the section in the form of rather dense perivascular infiltrations of round cells chiefly of the lymphoid series.

The blood vessels relative to these round cell infiltrations display moderate intimal proliferation and swelling of the intimal cells with, however, only a slight tendency to diminution of the lumen. In some areas the round cell infiltration shows occasional obliterated arterioles.

Diagnosis: Chronic myositis with degenerative changes in the muscle fibers.

BRIEF REVIEW AND DISCUSSION OF THEORIES OF CONGENITAL BONE HYPERTROPHY

The differentiation of congenital hypertrophy of the bone from osteitis deformans,

elephantiasis and acromegalia is usually made without difficulty.

The most important theories of the production of congenital hypertrophy of the bone are:

(1) Mechanical theory, advanced by Slingenberg,[1] associates excessive growth of the bone with twisting of the umbilical cord around a fetal segment, which results in venous stasis with eventual overnutrition and hypertrophy of the involved segment. Cases are reputed in which strangulation marks were present on hypertrophied limbs. Their absence in other cases, he said, may be explained by the fact that the compression of the efferent veins has been strong enough to interfere with circulation but not sufficient to induce marks persisting after birth. In a case reported by Mirau there was twisting of the umbilical cord around a fetal finger which was considerably hypertrophied.

Letuterer and Fischer[2] laid importance on another mechanical factor, namely, defective position of the embryo in utero with subsequent venous stasis and exaggerated nutrition and growth of a body part. Quillon considered pseudomembranous bands in the amniotic cavity a similar causative factor.

When the mechanical compression is slight, circulatory disorders occur slowly; hence, new vessel formations develop as nevi, whereas varices are usually absent.

(2) Vascular theory, promulgated by Cruveilhier[3] in 1856, like the mechanical theory, is based on the conception of a circulatory over-activity. Polosson[4] attributed congenital hypertrophy of the bone to a disturbance of the lymphatic system similar to that in congenital elephantiasis. According to Barwell,[5] bone hypertrophy is due to a deficient development of the muscular layer of the arteries; the resulting dilatation of the vessels causes overgrowth of the parts which they supply.

Trelat and Monod[6] sustained the hypothesis that partial paralysis of the vasomotors leads to a persisting increase of blood supply in some segment of the fetal body. Duzea, in 1886, asserted that the blood circulation plays a prominent part in partial hypertrophy, evidenced by the frequent coincidence of bone hypertrophy with angioma.

(3) Neurotrophic or "nervous" theory sustained by Widenmann[7] and Duplay explains excessive growth by irritation of the central nervous system. Stier[8] stated that changes in the subcortical centers or the cerebral hemispheres are responsible for hypertrophy of the bone.

No significant anatomopathologic lesions of the nervous system were ever determined to support the neurotrophic theory. In Wieland's[9] case a slight thickening of the perineurium was noted, but there were no signs of a degenerative process.

(4) Embryonal theory, first advanced by Cohnheim[10] and later supported by Wagner[11] and Bassel Hagen[12] and others, connects congenital gigantism of the bone with a primary developmental defect of the embryo.

Ahlfeld thought that excessive proliferation of cells in certain parts of the germinal layers leading to a superfluous amount of structural tissue, is the causal factor of bone gigantism. Wieland maintained that such excess of structural tissue is associated with dystrophic processes, namely, pathologic changes of the germinal protoplasm, especially in the middle layer.

A more recent theory promulgated by Kitajgorodskaja[13] is that: Overmaturation of an ovum gives rise to the formation of a superfluous limb bud. Plantation, by way of germinal emigration, of such ovum in an area containing an analogous ovum results in the fusion of two superfluous limb buds with consecutive hypertrophy of a whole limb or a part.

Broca and Massonaud[14] considered as an etiologic factor a yet unknown disturbance of epiphyseal and periosteal bone growth resulting in exaggerated nutrition and subsequent hypertrophy of the bone and the soft tissues.

(5) Other theories: Hereditary influence[15] has not been found by the majority

of writers to be a factor in the occurrence of congenital bone hypertrophy.

The theory of internal secretion holds that the hypertrophy is due to a biochemical reaction causing an irregular distribution of fetal tissues that interferes with the normal glandular secretions. However no correlation between partial gigantism and changes of the endocrine system has been usually observed.

Discussion of theories relating to the present case:

In our case no marks of compression or strangulation which might support the mechanical theory, were present at birth. It seems reasonable to admit that mechanical factors may induce elephantiasic growth of the soft tissues but not that of the bones.

Grieg reported an important mental defect in 20 per cent of patients with a congenital hypertrophy of the bone; and regarded the fact as indicative of a neurotrophic theory. The mental quotient of our patient showed 83, that is, only slightly below the average. No lesions of the nervous system were discovered.

In our patient, the vascular theory would apply as an explanation of the origin of the congenital tumors, that is, the two hemolymphangiomas; however it fails to explain the presence of other congenital defects.

Thus eliminating the three theories, mechanical, nervous and vascular, it seems that the embryonal theory which associates the bone deformity with a general defective constitution is most significant in our case in which several congenital abnormalities, of apparently different nature, coexist.

Spreitzer[16] discussing his case, which resembles closely our own case, is inclined to the theory of a pathologic change in the growth-regulating gene complex, and points out the association of a partial gigantism with a lipoma of the chest. In his case consanguinity of the parents might have promoted the pathologic change.

SUMMARY

(1) This is a case of "true hypertrophy," that is, one in which excessive growth of isolated bones of the feet is associated with voluminous lipomatosis of the plantar surface. The hypertrophy of the bone coexists with (a) two congenital vascular tumors; (b) asymmetry of the face; (c) strabismus; and (d) anomaly of the genital organs.

(2) The occurrence of hypertrophy of the toes is rare; it is even more exceptional that this malformation is combined with other congenital defects.

(3) The statistics show that hypertrophy of the toes is more frequent in males than in females.

(4) The operative findings revealed the presence of additional arteries in the areolar tissue of the hypertrophied toes, satisfying the augmented requirement of blood supply in the segment.

(5) The pathologic report of the involved bone demonstrated the presence of osteoporosis, fatty degeneration of bone marrow and active periosteal bone formation. This corresponds to Wieland's observations. The latter stated, contrary to what was taught by Caubet and Mercade, that hypertrophy of the toe is not a mere quantitative enlargement of the bone, because it presents histologic changes connected with hyperplastic and regressive processes.

REFERENCES

1. Slingenberg, B. Missbildungen von Extremitäten. *Virchow's Arch. f. Path.*, 193: 1–92, 1908.
2. Fischer, H. Der Riesenwucks. *Deutsche Ztschr. f. Chir.*, 12: 1–59, 1879–1880.
3. Cruveilhier, J. Traité d'Anatomie Pathologique, Paris, 1856.
4. Polosson, M. Anomalies de développement et tumeurs. *Lyon Med.*, 46: 585, 1884.
5. Barwell, R. Hypertrophy of lower parts of the face. *Trans. of Clin. Soc. of Lond.*, 8: 104–107, 1875.
6. Trelat and Monod. De l'hypertrophie unilaterale partielle ou totale. *Arch. Génér. de Med.*, 1: 536–558, 676–705, 1869.

[*For Remainder of References see p.* 168.]

HYPERPARATHYROIDISM WITH VON RECKLINGHAUSEN'S OSTEITIS FIBROSA CYSTICA GENERALISATA AND HYPOPITUITARISM

GERTRUDE M. JOHNSON, M.D., F.A.C.P.

Internal Medicine, Staff of Battle Creek Sanitarium

BATTLE CREEK, MICHIGAN

THIS report dealing with the study of a case of hyperparathyroidism with von Recklinghausen's osteitis fibrosa cystica generalisata and hypopituitarism is considered of value because of its atypical character, the consequent problems of differential diagnosis and the long period during which the patient was under observation.

History: The patient, J. W., a young married Dutch woman, aged thirty-one, was first admitted to the Battle Creek Sanitarium on November 16, 1930. Her chief complaint was muscular weakness, lameness, rheumatic pain and tenderness in her legs, especially the left thigh. Her illness began seven years previously following shortly after the birth of her last child in April, 1923. Except for one period immediately after the delivery of this child, she had never menstruated since. Shortly before this delivery her left leg began to ache at night after she had been on her feet all day, the pain preventing sleep, and gradually increasing in severity. In driving a car she used her left foot on the clutch, and it would be so weak and tired that she would have to lift the foot off the clutch with her hands. The leg always ached worse at night. She had used aspirin in gradually increasing amounts until her sister remarked at the time of entrance, "she just eats aspirin," without relief from the pain. The leg was not stiff, but when cold the muscles became so hard that she could scarcely move it. Both legs were troubling her on entrance. She felt better after massage relaxation and warmth. She believed the legs were swollen and said they were tender.

She had had her tonsils removed with the hope of relieving the aching in her legs, but there had been no improvement following the tonsillectomy. She then had all her teeth extracted with the same hope, but also without relief. The patient had had no head pains. Her eyes have not troubled her. She has had an abnormal thirst and passes an abnormally large quantity of urine, from five to seven quarts a day.

In February, 1929, a gland in the right groin became very swollen and hard. It was poulticed for several days and then lanced, but there was very little drainage. Nine months later the wound had not healed, and was still draining at the time of entrance to the hospital. Swollen glands in her neck were found that at time. Her bowel action was normal, one or two movements a day.

Family History: Both parents were living, her father was past seventy, had "a little rheumatism for a few days," otherwise he was well. The mother had cancer of the uterus and has since died. The patient had ten siblings, all living and well. Her grandparents on both sides were healthy; her grandfathers both lived to be over ninety.

Previous History: The patient was born in Massachusetts. Her health as a child was good except for measles and frequent attacks of tonsillitis. She had diphtheria as an adult. Her menstruation began at thirteen, was regular, very profuse, usually lasting a week. She was married at seventeen years and had four normal full term deliveries all before the patient was twenty-four years.

She weighed about 170 when she ceased menstruating, but has weighed up to 225 pounds since.



Fig. 1. High magnification. Specimen from left femur. Diagnosis: Decalcified bone shows a hemorrhagic cyst surrounded by granulation tissue, containing numerous giant cells of the bone absorbing type and small groups of atypical round celled sarcoma type. One giant cell, granulation tissue, a few round cells and two areas of bone. Paraffin section, stained with hematoxylin-eosin.

There is no history of any other illness in her life.

There are no symptoms at present with reference to her eyes, ears, nose, throat or mouth.

Habits: The patient lives on a mixed diet with large amounts of fruits and vegetables and some milk. Before she became lame she had a great deal of exercise assisting on the farm.

Physical Examination: A woman, 65.6 inches tall, weight 204 pounds, came in on crutches, trunk flexed slightly on the legs, temperature 99.4°F., pulse 96, regular but low tension. Her blood pressure was 110/70. Prognathism, submaxillary, cervical, inguinal and thyroid glands were enlarged. Special search later for para-

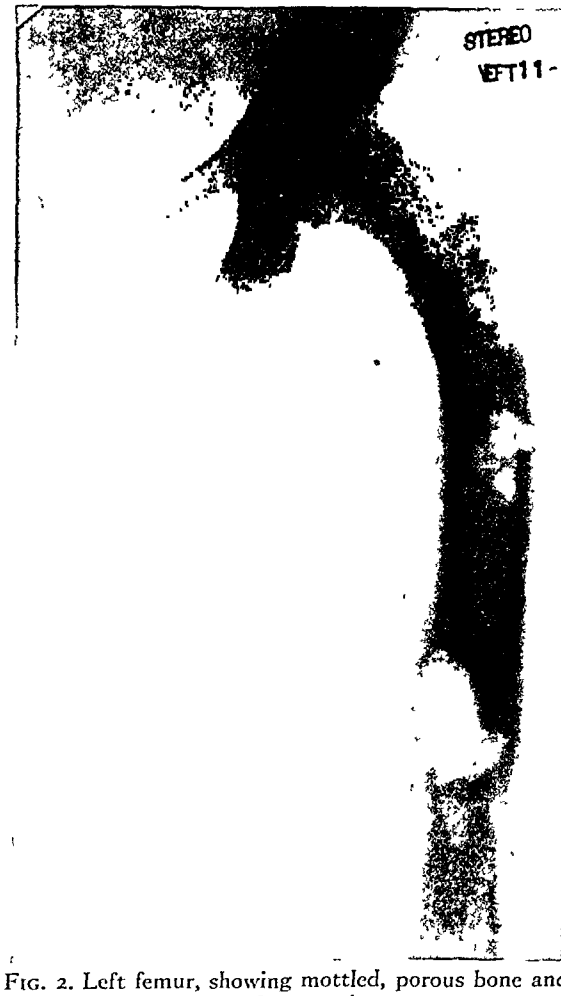


Fig. 2. Left femur, showing mottled, porous bone and cystic degeneration.

thyroid tumor disclosed nothing palpable. There was no grating in any of the joints. There is sense of stiffness and fullness of the muscles of the left thigh. When passing the hand lightly over the thigh there is a sensation of a swelling of the bone and this area is very sensitive. There is no discoloration of the skin. The patient wears full dentures, but the gums are normal. Pupils are equal size and regular outline and respond normally to light and accommodation. Fundus and perimeter test in November, 1930 and again in July, 1931 were both normal. The liver and spleen were of normal size. The heart tones were

diminished but no murmurs were heard. The lungs were normal. The abdomen presented a heavy fat deposit. Outlines of



Fig. 3. Marked weakness from decalcification from the skeleton. Inability to stand upright.

abdominal organs normal. An open wound from the right labia majora into the groin contains a granulomatous sausage-shaped mass. No pelvic abnormality was present except some laceration of perineum and fairly large hemorrhoids.

Roentgenogram of left thigh November 17, 1930 showed:

"At about the junction of the upper and middle third of the left femur a large cyst-like lesion. It was roughly oval in shape and measured about five centimeters in its longest diameter. The cavity of the cyst was apparently completely devoid of bony trabeculae and in antero-posterior view there was seen to be complete destruction of the inner margin of the femur for a

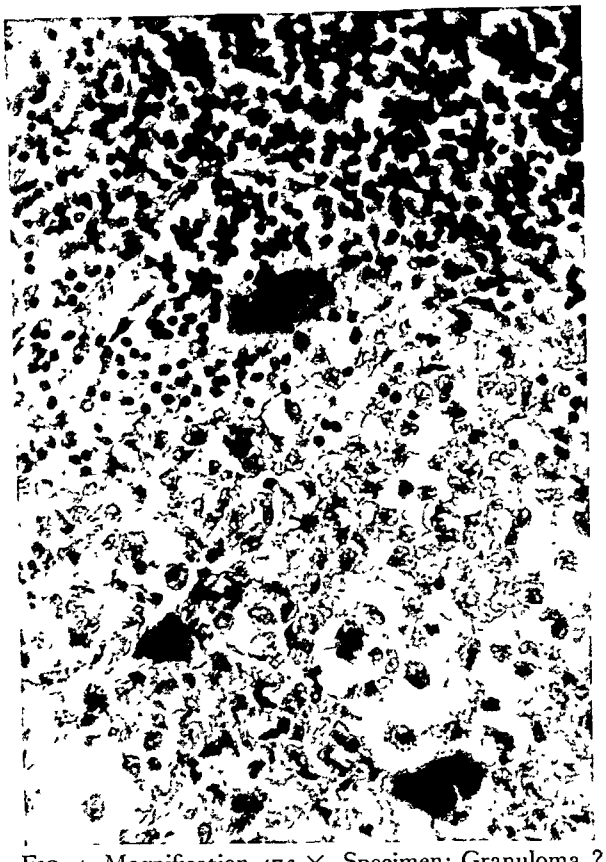


Fig. 4. Magnification 475 ×. Specimen: Granuloma ? from right groin. Diagnosis (A. S. Warthin, M.D.). Extreme proliferation of reticuloendothelial cells, almost neoplastic, with numerous giant cells of bone marrow type. Section paraffin embedded. Stained with hematoxylin-eosin.

distance which measured four centimeters on these films. Midway between this lesion and the lesser trochanter there was a small group of similar lesions exhibiting various lesser degrees of bone destruction.

"A survey of the entire skeleton a few days later revealed a large cyst at the middle of the right femur with two small lesions in the neck of the femur and a moth-eaten appearance of the distal fifth. A few lesions were found in the lower jaw and in the left eighth rib there was a mottled area of decreased density with some expansion of the cortex. This rib lesion was thought by roentgenologist to be characteristic of multiple myeloma."

The basal metabolism reports from −9 to −15 per cent.

The urinary output was 5300 to 5400 c.c. in 24 hours; specific gravity, 10.04, total solids 51 and 49 grams. There was no albumin, sugar, casts, crystals, blood, or any of the indol bodies; occasionally a few pus cells were found. Repeated special tests for the Bence-Jones protein were negative. The stool showed a great deal of putrefaction, some traces of blood, many fatty acid crystals, spore bearing bacteria, and 90 per cent of putrefactive organisms. The blood count always showed a secondary anemia with a count ranging from 2,830,000 to 3,770,000 red cells, 7800 white cells, 55 per cent to 64 per cent hemoglobin (Dare), grams 5.2 to 8.8. (Table 1.) The most noticeable feature of the blood counts has been the variation in the eosinophile count, apparently higher with activity of a lesion and subsiding with its quiescence, ranging from 19 per cent to 3 per cent.



Fig. 5. Left femur, March 26, 1931.



Fig. 6. Left femur, Oct. 23, 1934. The boneless, porous and cystic cavity filling in.

Fractional gastric test showed no free hydrochloric acid present. Histamine test was not made.

The serum analysis of the blood showed by Kolmer a negative Wassermann on November 17, 1930, and November 24. The Kahn test was also negative though patient had been given a provocative dose

Table 1

BLOOD CELL COUNT, REGULAR AND DIFFERENTIAL

Date	Hemoglobin			Cell Count per Cu. Mm.		Color Index		Differential Count Per Cent						Morphology
	Dare	Newcomer	Grams Per Cent	Red × 1000	White	Dare	Newcomer	Polymorphonuclear	Eosinophile	Basophile	Transitional	Lymphocytes Small	Lymphocytes Large	
11–19–30	56	46	...	3,610	7,500	78	64	72	3	1	1	23	...	Red cells vary slightly in size, few elongated red cells
12–7–30	59	48	...	3,960	5,100	76	62	54	16	0	1	29	1	Red cells vary slightly in size, few poikilocytes, many elongated red cells
12–28–30	56	46	...	3,600	6,000	78	64	57	11	4	2	25	1	Many elongated red cells
2–22–31	61	50	...	3,730	13,200	83	68	60.5	12	1	0.5	22.5	3.5	Many elongated red cells
4–15–31	49	40	...	2,960	7,800	83	70	60.5	11.5	1.5	1	20.5	2.5	Many elongated red cells
5–8–31	54	44	...	3,080	6,600	90	74	81	6	...	1	12	...	Red cells vary slightly in size; few elongated red cells
6–14–31	58	47	8.0	3,690	9,300	81	66	60.5	14.5	1	...	21	3	Red cells vary in size and shape; few poikilocytes and elongated red cells
7–12–31	58	47	8.0	3,680	9,600	81	65	64	15	1	...	20	...	Few poikilocytes and elongated red cells
8–9–31	53	43	7.3	2,830	8,700	95	77	67.5	17.5	3.5	...	10	1.5	Few poikilocytes and elongated red cells
10–4–31	56	46	7.8	3,360	7,200	85	70	63	19	0.5	1	14.5	2	Few poikilocytes and elongated red cells
11–22–31	55	45	7.6	3,770	5,100	75	61	64	15.5	1.5	0.5	17	1.5	Few poikilocytes and elongated red cells
1–18–32	64	52	8.8	3,950	8,700	83	67	72	7	...	1	17	3	Red cells vary slightly in size
6–1–32	55	45	7.6	3,560	6,000	79	64	65	6	...	...	28	...	Red cells vary slightly in size
9–7–32	52	42	7.1	2,970	5,100	90	73	64	8	2	1	25	...	Red cells regular
9–18–32	44	36	6.1	2,830	11,700	79	64	72	3	1	2	22	...	Red cells regular
10–9–32	41	33	5.6	2,760	6,000	76	61	75	3	...	...	22	...	Red cells vary slightly in size and shape
3–17–33	60	49	...	3,900	8,100	130	106	53	13	...	1	33	...	Red cells vary slightly in size
4–14–33	33	43	7.3	2,710	9,300	99	81	58	15	...	...	26	1	Red cells vary slightly in size
5–19–33	55	45	2.8	3,010	8,700	92	75	55	15.5	1.5	1.5	25.5	1	Red cells vary slightly in size
6–11–33	59	48	8.1	3,660	8,400	82	67	69	15	1	1	14	...	Red cells vary slightly in size
6–25–33	58	47	8.0	3,260	7,200	91	74	70	8	...	...	22	...	Red cells vary slightly in size
9–13–34	43	35	5.9	2,580	6,600	86	70	55	3	1	2	39	...	Red cells regular
10–23–34	54	44	7.4	3,460	8,700	80	65	72	3	2	...	23	...	Red cells regular

of neoarsphenamine. The patient's husband also gave a negative Wassermann reaction. On December 14, 1930, cerebrospinal fluid showed the following: quantity, 4 c.c.; appearance, colorless; cell count, 4 per cu. mm; globulin, (Pandy), trace; ammonium sulphate negative; gold chloride negative; Wassermann negative.

The non-protein nitrogen per 100 cc. of blood was 25.0 mg., uric acid 3.0 mg. and sugar 90 mg.

Tests for the calcium and blood phosphates made throughout the study are shown in the accompanying tables:

TABLE II
CALCIUM AND PHOSPHORUS DETERMINATIONS ON BLOOD

Date	Mgs. per 100 Cc. Calcium	Mgs. per 100 Cc. Phosphates
11–24–30	10.9	1.9
3–12–31	8.5	3.8
9–10–32	9.0	5.9
9–11–32	10.0	5.1
9–12–32	9.7	4.4
9–13–32	9.0	4.8
9–15–32	9.8	
9–18–32	10.2	4.4
10– 9–32	10.2	3.4
4–14–33	10.4	4.1
6–18–33	10.2	3.6
10–17–34	11.4	5

On December 14, 1930, a biopsy was done on the gland in the right groin. In January 1931 this tissue was reported by Dr. A. S. Warthin as follows: "Negative for spirochetes. Tissue presents the appearance of an infected hemorrhagic bubo, but there are several *atypical cell nests and numerous large giant cells.* The typical cell nests suggest very small metastases, but the appearances are not conclusive. Our general impression is that this is a severe bubo."

Summarizing the outstanding symptoms in the case up to this point, we have:

1. Marked muscular weakness with inability to stand upright
2. Deep, severe pain in the left thigh with swelling and tenderness over a localized area in the femur
3. Bilateral, general enlargement of the lymphatic glands
4. A secondary anemia
5. Variable but well marked eosinophilia
6. A normal blood calcium but rather low blood phosphate
7. Absence of Bence-Jones protein
8. *X*-ray evidence of osteoporosis with multiple bone cysts
9. Well marked polydipsia and polyuria
10. Total amenorrhea from age of twenty-four years.
11. Obesity, principally abdominal
12. Slightly lowered basal metabolism
13. Prognathism

On these grounds a tentative clinical diagnosis was made of generalized osteitis fibrosa cystica or Von Recklinghausen's disease with hyperparathyroidism and *hypopituitarism.*

On February 23, 1931, the patient was admitted for an enucleation of the granulomatous mass in the right groin and for a biopsy on the cyst in the left femur. The surgeon, Dr. Arthur H. Kretchmar, reported on the left femur:

"The cavity in the bone, at the upper part of our incision, could be palpated beneath the periosteum. The periosteum was opened, split upwards and downwards, and a good sized cavity in the femur was opened into. The bone was open on its posterior and inner aspect, the edges of the opening were very sharp. The sharp edges were bitten away with bone biting forceps. The cavity was very irregular, penetrating deeper in some places than others, and the same lined with a glistening membrane. There was no fluid or granulation tissue within the cavity.

"The *lining* was thoroughly curetted away, also the bits of bone from the edge of the opening and the lining tissue were curetted away and preserved for pathological study. Wound was closed in the usual manner."

In the center of the old wound in the right groin was a purplish granulomatous,

friable mass. Utilizing the cutting current this was removed strip by strip and found to extend beneath Poupart's ligament and into the saphenous opening, measuring at least 4 inches in depth. The bleeding points were ligated. Indoform gauze was packed down into the depth and two tension sutures were used to bring together the skin and deeper fatty tissue.

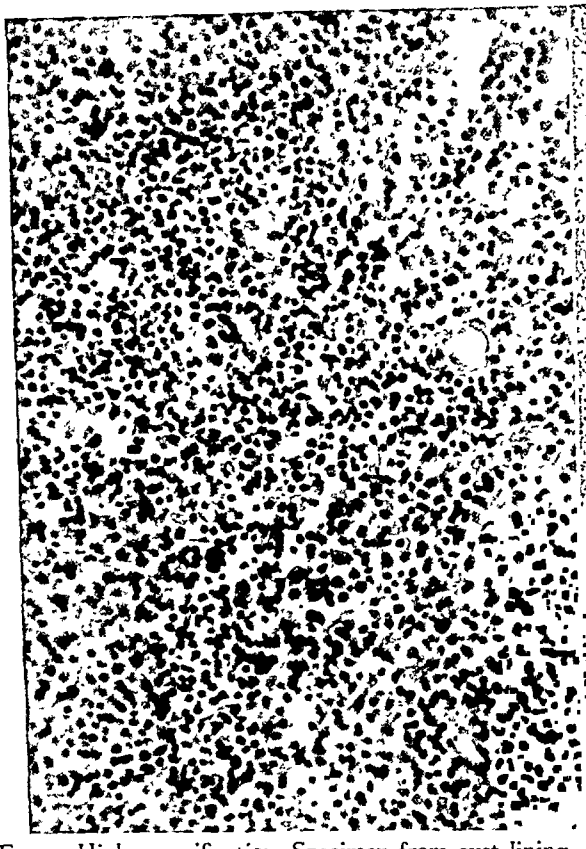


Fig. 7. High magnification. Specimen from cyst lining from bone cavity. Diagnosis: (A. S. Warthin, M.D.). Round cell sarcoma. Lymphoblastoma of myeloma type. Paraffin section stained with hematoxylin-eosin.

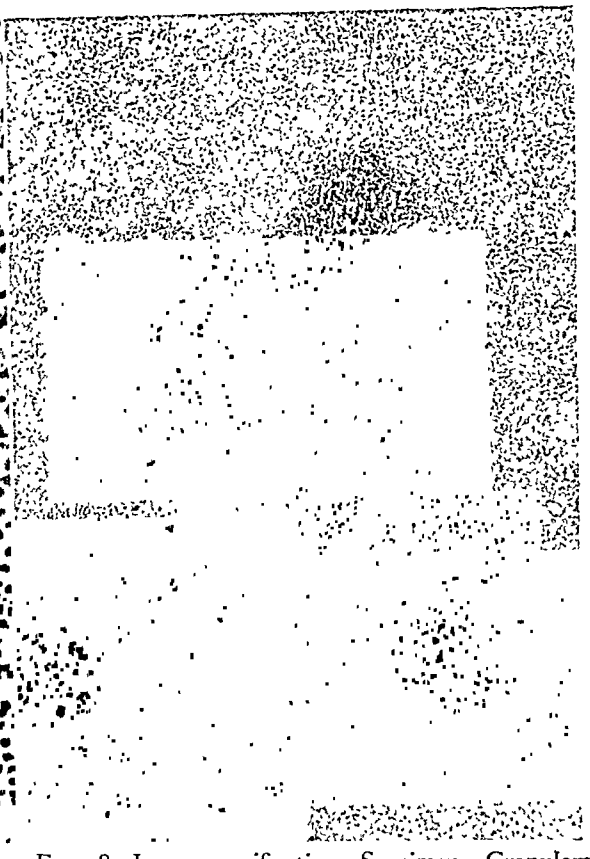


Fig. 8. Low magnification. Specimen: Granuloma? from right groin. Diagnosis (A. S. Warthin, M.D.). Extreme proliferation of reticuloendothelial cells, almost neoplastic, with numerous giant cells of bone marrow type. Section paraffin embedded, stained with hematoxylin-eosin.

Precaution was used to prevent any fracture of the leg which could easily have occurred as the bone cyst involved more than 50 per cent of the circumference of the femur.

The pathological report made by Dr. A. S. Warthin on "cyst lining from bone cavity" was: "round cell sarcoma, Lymphoblastoma of myeloma type." The tissue from "Granuloma (?) from right groin" was: "Same picture as before. Extreme proliferation of reticulo-endothelial cells, almost neoplastic, with numerous giant cells of bone marrow type." "In view of this material, this patient has a multiple neoplasm of bones falling into the group of lymphoblastoma or myeloma with metastases in inguinal glands. The case is of particular interest because of the appearance in the inguinal gland of large numbers of giant cells of bone marrow type. It would appear to be a metastasizing bone marrow tumor."

Deep *x*-ray therapy to the cystic area in the bone and Coley's fluid intravenously were instituted.

From the beginning the patient had been on a diet rich in calcium and vitamins and low in carbohydrates and received calcium lactate, 10 grs. t.i.d., a small amount of thyroid extract and whole gland pituitrin.

Later the thyroid was discontinued and she was given Viosterol, 250 D., and ultraviolet radiation to the body.

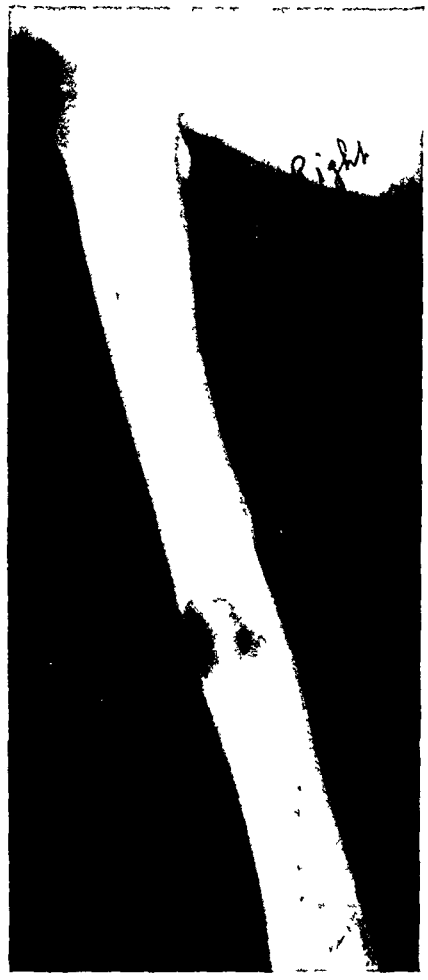


Fig. 9 Right femur, August 9, 1931.

Late in March her glandular enlargement had increased very decidedly; glands filled the submaxillary triangle and the cervical region. Repeated *x*-ray study of the bones showed a very rapid progress of the disease. A new area in the left eighth rib showed mottled, decreased density with some expansion at the cortex.

Up to June, 1931, although the patient had lost steadily in weight, so that on June 14th she weighed 179 pounds, she reported very little aching remaining in the left leg or thigh. Her trunk seemed to be more flexed on her thighs than formerly but x-ray films showed no abnormality of the vertebra. The glandular condition seemed unchanged. Polydipsia and polyuria persisted still.

A check-up *x*-ray examination of the



Fig. 10. Lesion in left clavicle, Feb. 17, 1933.

bones about this time showed no material improvement, in fact the right thigh appeared to be worse. By the middle of July there was increased soreness, tenderness and pain in the right thigh but no soreness in the left thigh since the biopsy. The *x*-ray pictures showed an increase in the size of the cyst in the right thigh.

In August, 1931, the submaxillary and cervical glands were still more enlarged and her blood count had gone down again, though the eosinophiles were up to 17.5 per cent. She was therefore transfused. In September the patient was still complaining of a great deal of pain in the right thigh and the glands in the neck had further increased.

Early in October, 1931, we noted more enlargement of the axillary glands. There was still a great deal of pain in the right thigh and also pain in the back. The eosinophiles were 19 per cent. By December the pain had begun to subside again and the patient looked and felt better, the glands in the neck were smaller. The

eosinophiles were now 15.5 per cent and January 18, 1932, were only 7 per cent.

X-ray films in February, 1932, showed a

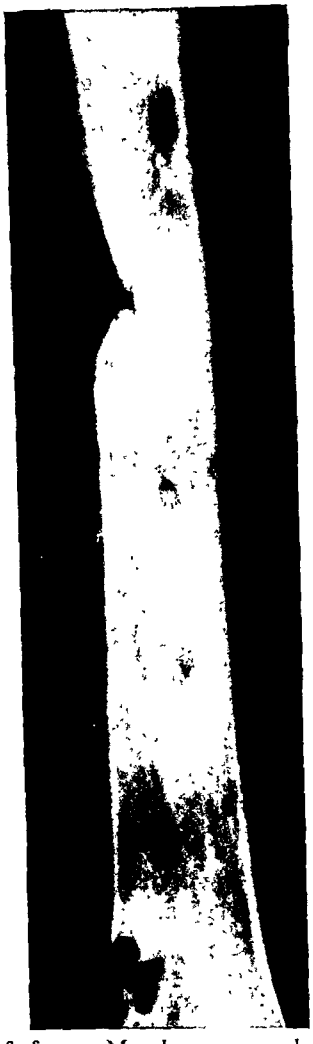


Fig. 11. Left femur, March 17, 1933, showing progressive activity in new lesions.

decrease in the size of the lesion of the left femur, though it was increasing in the right leg. In March the swelling in the right thigh had disappeared entirely and it was no longer painful, and she was beginning to regain weight. There was still a great deal of doubt of the diagnosis, with preponderance of opinion for multiple myeloma.

In the spring of 1933 Dr. Plinn Morse, writing with reference to the case, said: "The question of multiple myeloma can quite often not be settled on the basis of the clinical data which we possess. The *x*-ray findings, blood calcium and chronaxie of advanced multiple myeloma are all identical with osteitis fibrosa cystica, and

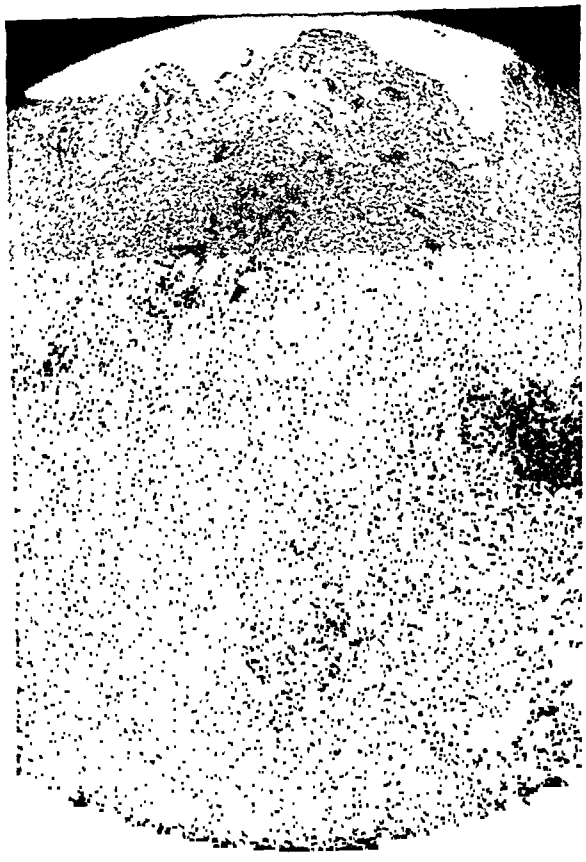


Fig. 12. Magnification 65 ×. Specimen: Cyst lining from bone cavity. Diagnosis: (A. S. Warthin, M.D.). Round cell sarcoma. Lymphoblastoma of myeloma type. Paraffin section, stained with hematoxylin-eosin.

the only way to differentiate is to do a biopsy on a point in the skeleton which looks most suspicious in the *x*-ray of multiple myeloma, and make the decision directly from the section.

"There has been suggestive evidence that multiple myeloma may be a malignant form or end-stage of osteitis fibrosa cystica. Some years ago I published an article on Multiple Myeloma of the Bones (*Jour. of Cancer Research*, Vol. 5, No. 4, Oct. 1920) in which I came to the conclusion that multiple myeloma of the *plasma cell type was really of osteoblastic origin and not related to the blood forming or marrow tissue.*"

In June, 1932, roentgenographic check-up of the entire skeleton revealed the follow-

ing: In the skull was a small punched out area close to the upper margin of the right parietal bone. This was the first time we had found a lesion in the skull. *The lesion in the eighth rib now appeared as two small cysts.* The cortical expansion seen in November, 1930, had disappeared. *There was a deformity in the lower third* of the right humerus which appeared to have been caused by the healing of an old fracture. The large lesion in the middle of the left femur showed little if any change, but numerous small lesions appeared above and below it. The large lesion in the middle of the right femur was increasing in size, and there were also numerous lesions above and below it. Two small lesions appeared to be in the right ilium and a group of three or four were in the upper part of the left ilium. In the head and neck of the left femur we found a number of small areas of decreased density and in the head of the right femur was a large area of decreased density measuring at least an inch in diameter.

By this time the differential diagnosis had been narrowed down to either multiple myeloma or hyperparathyroidism. Because of the generalized enlarged glands our surgeon, still questioning the diagnosis and feeling that with such extensive metastases, as proved pathologically, nothing would or could be accomplished, hesitated to explore for parathyroid adenoma. We had been unable to palpate anything that might be taken for a parathyroid tumor in the neck. Dr. Kretchmar later in the year discussed the case with Dr. Max Ballin. Since one case had been relieved by parathyroid surgery, even though the patient had had *glandular enlargement,* the surgeon became less skeptical about surgery.

An exploratory operation for possible parathyroid adenoma was done September 9, 1932. "On the right side at the point where the inferior thyroid vessels divided, was what appeared to be an enlarged parathyroid, or parathyroid adenoma about 1.5 cm. in length, 1. cm. in width and .33 cm. in thickness. The left side was then explored and two small glands were found on the posterior surface of the thyroid which resembled parathyroid glands. About two-thirds of the glands on the left side and all of the tumor on the right side were excised, thus forming what we believed to be a partial parathyroidectomy. The pathological examination disclosed that what had been supposed to be parathyroid adenoma was not parathyroid tissue at all."

Three days later the surgeon reopened the incision. "Owing to the nodular state of the left lobe of the thyroid a left lobectomy, right down to the posterior capsule, was carried out. A small, hard body, about ⅜ inch in diameter was encountered on the side of the trachea and this was also removed. The thyroid fascia was opened posteriorly and finger exploration upward and downward and in back of the esophagus was carried out but no tumor was found."

Blood calcium following the first operation was 9.0, 9.6 and 9.7 mg. per 100 c.c. Blood calcium following the second operation was 9.0, 9.7, 9.8, 10.2 mg. and phosphates 5.9, 5.1, 4.4. mg.

By the latter part of December, the glands in patient's neck were definitely smaller and gradually disappeared entirely.

On September 30, 1932, the patient reported a slight sign of a menstrual period. On November 6th she had quite a normal three-day menstrual period. After that time there was a period every other month, some more normal than others. This continued through August, 1933, after which the function ceased.

On November 13, 1932, checking up by *x*-ray, the one lesion which had been operated on was filling up, all the others were worse than they were when the last *x*-ray was taken in June, 1932.

In December, 1932, a study of the calcium balance was made. Patient was hospitalized and put on a carefully analyzed diet and distilled water, under the strict care of an experienced dietitian.

For a three day period all the urine and stool were collected, a charcoal tablet being used as a marker at the beginning and end of the diet period.

RESULTS

	Mgms.
Total excretion of calcium for 3 days..	1538
Total intake of calcium for 3 days.....	1224
Excess elimination over intake.....	314
Negative balance of.....	25.7 per cent

In February, 1933, the patient complained of a sore, tender place about the middle of the left clavicle and her left arm was quite helpless. This lesion appeared to be exactly the same kind as those in her legs. An *x*-ray showed a cyst in the center of the clavicle. The glands in the neck still continued to diminish in size.

X-ray of dorsal spine and ribs in March, 1933, showed no evidence of a vertebral lesion. The two small cysts in the left eighth rib were still present as well as an early new lesion situated about two inches proximally and another irregularly oval cystic area in the left sixth rib, close to the articulation.

In April, 1933, the cyst in the left clavicle was still active. The blood count dropped but the eosinophiles rose. One lymphatic gland in left cervical region was enlarged and active.

In June, 1933, the lesion in the left clavicle showed improvement over the findings of February 17, 1933. No lesion of the scapula was recognized, but there was a suspicion of involvement of the surgical neck of the humerus. The right shoulder showed no evidence of lesion.

During the summer of 1933, an enlarged gland in the left inguinal region broke through the skin, resembling the granulomatous mass originally found in the right groin. During the following winter this gradually subsided and finally disappeared. The patient returned to her home and was not seen from December 1933 until the latter part of October 1934, when she was admitted for check-up routine. She was considered more deformed than when seen about ten months previously, her height had diminished nearly a foot, her trunk was flexed on her legs to more than right angle when attempting to stand and her legs were strongly flexed on thighs. From the *x*-ray apparently this was not due to any retrograde condition in the bones but rather to sitting constantly in one position until she was no longer able to straighten out her legs. She had gained twelve or fifteen pounds weight. Physical examination revealed nothing new other than this greatly increased deformity with associated pain and stiffness in both knees. A seropurulent discharge persisted from both groins though the enlarged lymphatic glands had entirely disappeared, as well as in the cervical and axillary regions. Residual soreness in the left thigh but no aching was present.

Polydipsia and polyuria were about the same. Blood chemistry showed an increase in the non-protein nitrogen to 40.9 mg. blood calcium 11.4, mg. and blood phosphorus 5 mg. per 100 c.c. The blood count was practically unchanged except that there was a total absence of eosinophiles. The urine for the first time showed albumin 5 per cent per volume.

X-ray examination of all the bones was rendered difficult from a technical standpoint by the fact that the patient's legs and trunk were fixed in the sitting position, together with a gain of thirty pounds in weight. No new lesions were found and all the old ones showed a very definite improvement.

After patient's return home, the conditions remained stationary except for occasional gastrointestinal upsets with cramping pain, vomiting and purging until the middle of January, 1935, when she became acutely ill with what her local physician diagnosed as a heavy "bronchial cold." She died February 8, 1935. During the last illness the diarrhea was so profuse as to require diapering. In the last few days patient was stuporous. There were slight attacks of rigidity with convulsive twitchings.

Because this case did not conform to the classic and typical descriptions of any of the bone tumors it has been difficult from the onset. Nevertheless, after careful study, it was diagnosed as in the foregoing and so presented to the Staff of the Battle Creek Sanitarium in April, 1931. It aroused a good deal of discussion and there was a variance of opinion as to the diagnosis, revolving particularly about hyperparathyroidism with generalized osteitis fibrosa cystica and multiple myeloma. The normal blood calcium and phosphate were at that time considered by many as very much against hyperparathyroidism.

Dr. Russell Wilder in a personal communication to me about that time said:

"Usually the blood calcium is elevated, but the progress of the disease is probably an intermittent one, and patients are likely to come in in an inactive stage with normal blood figures. A low or normal blood calcium, therefore, does not exclude hyperparathyroidism. By the same token a high blood calcium does not prove the presence of hyperparathyroidism since high figures are seen in other conditions of rapid bone destruction, for instance, a condition such as metastatic carcinoma."

The fact that the history of this patient's illness covered a period of fourteen years, the last four and a half years under observation, and that during that time she gained weight rather than lost was against the diagnosis of multiple myeloma.

Dr. Warthin's pathological reports on the biopsy specimens were thought to favor a diagnosis of multiple myeloma with glandular metastasis, but when the glands gradually but completely disappeared, another point was made in favor of hyperparathyroidism.

While we found no adenoma of the parathyroid, even after careful search, parathyroid tissue was removed and improvement followed both in the gland condition and in the bones, but not sufficient although it appeared as if there still might be parathyroid adenoma somewhere in the mediastinum. DuBois studied a case in which at operation no tumor was found, nevertheless, two normal appearing parathyroid glands were removed. Afterward the blood calcium was a little lower and the *x*-ray revealed a deposit of calcium in the bone. The patient gained strength and in four months was able to work in an office eight hours a day. In this instance there was hyperfunction of the parathyroid gland in the absence of any noticeable hypertrophy.

In the case reported by Barr, Bulgar and Dixon,[5] their patient had a tumor of the maxilla diagnosed previously as a giant cell tumor on biopsy. They reported the tumor as becoming smaller.

Rowntree and Allan of the Mayo Clinic were present when this case was presented and they recognized a similarity between that case and one observed in their clinic[6] as hyperparathyroidism and completely studied from that standpoint. Dr. Russell M. Wilder[7] of the Mayo Clinic, in commenting on these cases, said:

"In the cases of hyperparathyroidism thus far reported the disease was in adult men or women and produced either by tumor (adenoma or carcinoma) of a parathyroid gland or, as in the case of DuBois, by *hyperfunction of otherwise normal parathyroid glands.*

"The fact that a tumor was not found in DuBois' case is interpreted as indicating that hyperparathyroidism may result from the hyperfunctioning of otherwise normal glands. It is impossible to account for the giant-cell tumors which occurred in the case reported here and also that of Barr, Bulgar and Dixon.[5] Such tumors have been noted previously in association with osteomalacia and osteitis fibrosa. It is remarkably interesting that following parathyroidectomy in the case here reported a tumor of the maxillary bone disappeared, or at least decreased in size, to such an extent that it was no longer palpable."

We also know[10] that "parathyroid tumors may be deeply situated behind the trachea or even in the mediastinum."

COMMENTS

(1) In this case perhaps one of the most noticeable features has been the practically normal blood calcium and blood phosphorus at all times, though the research to obtain the calcium balance done in December 1932 showed a negative balance of 25.7 per cent.

(2) Another unusual feature which delayed parathyroid surgery was the marked glandular enlargement almost equaling that seen in Hodgkin's disease and the metastasis of large numbers of giant cells of the bone marrow type into these glands.

(3) The eosinophilia, apparently varying with the activity of the disease, is a feature that I have not seen recorded previously. One pathologist, reporting on the lining of the bone cavity said: "the cytoplasm of practically every cell contains granules of eosinophile type." The question of eosinophilia in osteitis fibrosa cystica was discussed by Dr. Harold H. Sanguinetti, of London, with Dr. Donald Hunter, who in turn referred it to Dr. Janet Vaughan, who has been studying the relationship of disordered hemopoiesis to bone disease. In her report she said: "In 7 authenticated cases with a parathyroid tumor there is no eosinophilia." Dr. Sanguinetti, in a personal communication, expressed the opinion that the increase in the number of eosinophiles during the development of a fresh cyst favors the diagnosis of osteitis fibrosa cystica, for a breakdown of proteids resulting in the formation of such a cyst and their absorption would be likely to lead to an increase of eosinophiles.

(4) The amenorrhea at twenty-four years of age has been another unusual feature of the case and one I had difficulty in attributing to the parathyroid disturbance. May it not be that the patient's size, suggesting acromegaly, the prognathism, the type of the obesity and the fine soft skin, were in the beginning due to a hyperpituitarism, or increase in acidophilic cells, and that later on the amenorrhea may have been an expression of the compression of residual normal elements?

REFERENCES

1. Askanazy, M. *Arbeiten a.d. pathologisch-anatomischen Institut zu Tubingen*, 4: 398, 1904.
2. Askanazy, M. Hyperparathyroidism: tumor of parathyroid glands associated with osteitis fibrosa. *Endocrinology*. 13: 232 (May–June) 1929.
3. Gold, H. Entfernung eines Epithelkorporperchentumors wegen Ostitis Fibrosa. *Wien. med. Wchnschr.* 77: 1734, 1927.
4. DuBois, E., J. C. Aub, W. P. Bauer and Richardson, N. Personal Communication.
5. Barr, D. P., H. A. Bulgar and Dixon, H. H. Hyperparathyroidism. *J. A. M. A.*, 92: 951–952, 1929.
6. Rowntree and Allan. *Jour. Endocrinology*, 13: 233 (May–June) 1929.
7. Wilder, Russell M. Hyperparathyroidism: Tumor of parathyroid glands associated with osteitis fibrosa. *Endocrinology*, 13: 243 (May–June) 1929.
8. Collip, J. B. The extraction of a parathyroid hormone which will prevent or control parathyroid tetany and which regulates the level of blood calcium. *Jour. Biol. Chem.*, 63: 395–438, 1925.
9. Bodansky, Aaron and Henry L. Jaffee. Parathormone dosage and serum calcium and phosphorus in experimental chronic hyperparathyroidism leading to ostitis fibrosa. *Jour. of Exper. Med.*, 53: 591 (May) 1931.
10. Hunter, Donald. Hyperparathyroidism: generalized osteitis fibrosa. *Brit. Jour. Surg.*, 19: 203 (Oct.) 1931.
11. Cushing, Harvey. Dyspituitarism. *Arch. of Int. Med.*, 31: 487 (April) 1933.
12. Snapper, I. Parathyroid tumor and changes of the bones. Amsterdam, Holland. *Arch. of Inter. Med.* (Sept.) 1930.
13. Noble, T. P. Generalized cystitis fibrosa cystica associated with parathyroid adenoma. *The Jour. of Bone and Joint Surg.*, 14: (Jan.) 1932.
14. Craig, J. Salisbury and Shearer, Jas. H. Osteitis fibrosa with initial symptoms resembling rheumatic infection. *Brit. Med. Jour.* (July 5) 1930.
15. Meakins, J. C. The clinical aspect of disturbances of the parathyroid gland. *Can. Med. Asso. Jour.*, 24: (May) 1931.
16. Evans, E. T. Osteitis Fibrosa, monocystic, polycystic, and diffuse. *Radiology*. 13: (Dec.) 1929.
17. Waters, C. A., and Kaplan, I. I. Osseous System. Year Book of Radiology. 1932.
18. Dresser, R., and Hampton, A. A. Osteitis fibrosa cystica generalisata with hyperparathyroidism as etiology. *Amer. Jour. Roentg.* and *Radium Ther., 25*: (June) 1931.
19. Cosin, C. F. Hyperparathyroidism: a case of osteitis fibrosa cystica with cystic adenoma of parathyroid. *Guy's Hospital Reports*, 81: (July) 1931.

BENIGN BONE CYST*

A REPORT OF 3 CASES LOCALIZED IN THE HUMERUS

ROBERT D. FAIRCHILD, M.D.

Resident in Orthopedics, The Receiving Hospital, Detroit

ROCHESTER, MINNESOTA

INTRODUCTION

THREE adolescents with fractures through bone cysts in the humerus were admitted within one month in the summer of 1934, to the Orthopedic Department of the Receiving Hospital. Fracture with minimal trauma, and without previous symptoms of bone cyst or bone tumor had been noted in each instance. They were treated conservatively and all healed with varying prognoses, as judged from radiographic and clinical examinations. One case came to operation about a year later with a good result while the other two are continuing conservative therapy. It is proposed to summarize these cases with the end result of each and to review briefly our present knowledge of the condition.

ETIOLOGY AND PATHOGENESIS

The benign bone cyst usually occurs in adolescents[2] under twenty years of age and a case has been reported in an infant.[6] Females are more subject to them than males.

Theories as to their origin are not numerous but the question is still unsettled. Bloodgood states that the etiology is unknown. Their derivation from a traumatic hematoma of the medullary portion of the bone first postulated by Beneke (quoted by Brunschwig[5]), is reemphasized by Lang,[8] but trauma is not a factor according to Bloodgood.[2] Virchow's theory was that of a degenerating cartilagenous tumor. Localized osteitis fibrosa has been suggested. Phemister[12] and his co-workers[5,13] postulated an infectious origin and believed that the benign giant cell tumor had a similar origin. This view was based on the fact that he found giant cells in the lining of a benign cyst. Santos[13] showed that apparently normal bone marrow may infrequently contain staphylococcus aureus and subtilis bacillus. Streptococci and staphylococci, according to Santos are recoverable from the contents of solitary bone cysts. Cysts and osteitis fibrosa cystica may arise from either local or general processes (Bloodgood).

PATHOLOGY AND MICROSCOPIC FINDINGS

A benign bone cyst may have a connective tissue lining or no lining at all or it may be filled with connective tissue showing signs of chronic inflammation.[2,4,12] Occasionally cartilage and giant cells are found in the bloody fluid contents in the benign bone cyst. The degeneration of a cartilagenous or benign giant cell tumor might be postulated from these findings (Phemister).

The case which came to operation showed only marrow fat within the cyst and no connective tissue lining. The periosteum was thickened due to low grade chronic inflammation. The decalcified sections of the cyst wall showed hypertrophic and sclerosed bone. Sections were examined by Dr. O. A. Brines, Pathologist.

SYMPTOMS AND X-RAY FINDINGS

The patient with benign bone cyst is probably most frequently brought under medical care for the treatment of a fracture the result of minimal trauma;[2,6] Bartlett's case[1] and one of ours threw a baseball. On the other hand, the patient may present

* From the Department of Orthopedics, The Receiving Hospital, Detroit, Michigan.

himself with swelling, pain, tenderness, shortening, bowing and atrophy or any combination of these;[5] and egg shell crackling may be present.[14]

Radiographic examination reveals a localized and well circumscribed area of uniform rarification in the diaphyseal porion of the bone.[10,11] The cortex is thinned as the cyst increases. There is no periosteal reaction. Evidence of filling in of the cyst after fracture[4] or surgical treatment[9] is best seen in the radiograph. That a central bone lesion cannot be adequately diagnosed radiographically is emphasized by Bloodgood.[3]

DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

The diagnosis depends on the history, the physical examination and the radiograph[7] which shows the bone lesion in the diaphysis near the proximal end. Periosteal reaction is absent and only a thin shell of cortical bone encases the cystic area.

The principal function of differential diagnosis is to rule out malignant central bone tumors. In sarcoma[7] there is a longer duration of symptoms, earlier fracture and expansion of the bone and periosteal changes as seen in the radiograph. Echondromas are usually epiphyseal in position. Central sarcoma, fibrosarcoma, myxoma and solid osteitis fibrosa occasionally are difficult to differentiate from benign bone cyst but fortunately are rare and microscopic study of excised tissue may give the clue to its malignancy or benignancy.[3] When syphilis is present, the serological reaction of the blood should show it and there is often a periostitis. Tuberculosis is eliminated by clinical signs and increased bone density. Abscesses show sclerosis and irregular walls with sequestrum formation. Cyst due to subperiosteal hematoma and callus cysts occur occasionally and are eliminated by the history of trauma, fracture or scurvy. Multiple cysts[2] occur in osteitis fibrosa, osteitis deformans, osteomalacia, echondromata, sarcoma and in mercurial poisoning. Multiple radiographs will demonstrate these conditions. Fifty per cent of giant cell tumors are in the lower end of the radius and all recover (Bloodgood).

TREATMENT

"The best treatment of a bone cyst is a comminuted fracture."[4] In all of our cases fracture was followed by solid healing although this was not painless in one. (Case III.) Operation should probably be advised for all progressive central lesions of bone, to break down the wall in benign lesions and remove tissue for microscopic examination in the case of suspected malignancy.

PROGNOSIS

Treated as a fracture[6] or operated[3,5,9,10,11] they usually do well and rarely give rise to further trouble.

CASE REPORTS

Case I. I. G. On August 2, 1934 a husky white female, age thirteen fractured her right humerus in attempting to throw an indoor baseball. There was no history of pain in her right arm previous to her injury and she had never suffered a fracture of any other bone. The past history of the patient and the family history were essentially negative. Physical examination except for the obvious signs of fracture of the right humerus was negative.

Radiographic examination of the right humerus revealed an oblique fracture at the junction of the upper and middle thirds. The fracture extended through the lower end of an oval unilocular cystic area, 3 cm. in length, its walls extending outward nearly to the limits of the cortex.

The value for hemoglobin was 13.2 grams per 100 c.c. of blood. There were 4,280,000 erythrocytes and 13,800 leucocytes per c.m. of blood. The blood smear revealed 56 filamentous, 8 non-filamentous polymorphonuclear neutrophiles and 36 lymphocytes in 100 cells. The Kline test for syphilis was negative. The value for the serum calcium was 11.1 mgm. per 100 c.c. of serum and that for serum phosphorus 4.7 mgm.

The arm was treated for four weeks in a Thomas splint with traction on the distal fragment by means of a Spanish windlass.

She was discharged from the hospital with the forearm in a sling and a coaptation splint about the fracture site on September 5, 1934.

She returned for reexamination on March 13, 1935 and was found to have a normally functioning extremity without weakness. There were occasional light pains at the fracture site. Radiographic examination at this time showed that the fracture had healed. The bone cyst had not diminished in size and the cortex of the bone was quite thin. Because she had no symptoms operative interference either by bone transplant or by crushing of the cyst wall and removal of its contents was refused by her parents.

The prognosis in this case is refracture through the cyst wall with minimal trauma.

Case II. G. M., a white male of Syrian extraction, aged eleven years was admitted on July 7, 1934 with a history of falling from a fence, sustaining a break in the shaft of the left humerus. The past history of the patient and his family were irrelevant. The patient had had no previous fractures. Physical examination was negative except for the fracture of the left humerus.

Radiographic examination revealed an irregular transverse fracture of the upper third of the left humerus through an area of cystic degeneration.

The value for hemoglobin was 12 gms. per 100 c.c. of blood. There were 8850 leucocytes per cm. of blood and the smear showed 63 filamentous and 5 nonfilamentous polymorphonuclear leucocytes and 32 lymphocytes. Other laboratory tests were not recorded.

The arm was treated in a Thomas splint with Spanish windlass traction for a period of four weeks and he was discharged from the hospital on August 10, 1934.

The patient returned March 13, 1935 and at that time had slight weakness of the left arm. Movements were normal and painless in all directions. Radiographic examination revealed some obliteration of the cystic area in the upper third of the humerus with a fairly competent looking cortex about the cystic area. The parents had previously been considerably perturbed by the prospect of operation so they were advised that the boy had a fairly strong arm but that there was a possibility of refracture through the cystic area in the left humerus.

Case III. A white female, age fifteen was admitted August 3, 1934 with a history of falling from a slide. There was a fracture of the left humerus but no other injuries were noted. She had never had a previous fracture and there had been no pain or weakness in the left arm at any time. The patient's past history and her family history were negative.

The arm was dressed in a Thomas splint and radiographic examination showed an oblique fracture at the junction of the upper and middle thirds of the left humerus with the fracture extending through an area of cystic degeneration. Portable radiographs showed beginning healing of the fracture at the end of three weeks; motion was started at the elbow and the patient was discharged to the Out Patient Department with her arm in a sling.

Laboratory examinations showed a normal urine and a negative Kline test for syphilis. There were 12.8 gms. of hemoglobin per 100 c.c. of blood and 3,720,000 erythrocytes and 9900 leucocytes per cm. of blood. The differential smear showed 62 filamentous and 12 nonfilamentous polymorphonuclear leucocytes and 26 lymphocytes. There were 10.4 mgms. of calcium and 4.8 mgms. of phosphorus per 100 c.c. of blood.

The patient returned March 13, 1935 and reexamination demonstrated that motions in all the joints of the left upper extremity were normal, but there was weakness of the left arm and the patient complained of pain in the old fracture site. There was no atrophy of the shoulder or arm muscles and the grip of the left hand felt as strong as that of the right. Radiographic examination showed partial filling in of the cystic area with complete obliteration of the fracture site. The patient continued in this condition until July 13, 1935 when operation was advised to allow complete filling in of the cystic area and strengthening of the humerus by callus and new bone formation.

Incision was made on the outer aspect of the upper third of the arm and the periosteum was reflected from the cystic area. A trephine opening was made with chisel and a rongeur served to remove most of one side of the cyst wall. The contents of the cyst and portions of its wall were sent for microscopic study. There was no lining of the cyst and the contents had the consistency of soft butter. The soft parts were allowed to fill in the cavity and the wound was closed tight. An airplane spica was applied.

Microscopic study of the cyst wall and its contents was made by Dr. Brines: "The sec-

tions of soft tissue in themselves are not diagnostic, consisting only of a small amount of marrow fat, thickened periosteum and calcified material which is apparently not bone but represents a lime salt deposition. The decalcified sections consist of hypertrophic and sclerosed bone. No cyst wall can be identified. The periosteum is thickened apparently due to low grade chronic inflammation."

Beginning healing with callus formation was revealed on radiographic examination five weeks after operation when the cast had been removed.

CONCLUSIONS

1. Three cases of benign bone cyst of the humerus are reported.
2. The etiology of the benign bone cyst is unknown.
3. Fracture with minimal trauma is the most frequent early symptom.
4. A localized, well circumscribed area of uniform rarefaction in the central portion of the proximal diaphysis of the long bones with a thin cortical shell is seen on the radiograph.
5. The history, the age of the patient, the radiographic examination with later follow up establish the diagnosis.
6. The treatment is that of the fracture or surgical evacuation of the cystic contents and crushing of the bony wall.
7. The serum calcium and phosphorus is unchanged in cases of benign bone cyst.

REFERENCES

1. Bartlett, Edwin I. A bone cyst of the humerus. *Surg. Clin. N. Amer.*, 2: 449, 1922.
2. Bloodgood, J. C. Benign bone cysts, osteitis fibrosa, giant-cell sarcoma and bone aneurysm of the long pipe bones. *Ann. Surg.*, 52: 145, 1910.
3. Bloodgood, J. C. Bone cysts (osteitis fibrosa): variety-polycystic osteitis fibrosa. *J. Radiol.*, 4: 1, 1923.
4. Bloodgood, J. C. Bone tumors, benign bone cysts due to central osteitis fibrosa of the unhealed latent type. *J. Radiol.*, 4: 345, 1923.
5. Brunschwig, A. Solitary bone cysts of long duration (case report). *Jour. Bone & Joint Surg.*, 28: 141, 1930.
6. Ireland, J. Bone cysts; report of cases. *Ill. Med. Jour.*, 49: 217, 1926.
7. Jostes, Fred A. Diagnosis and treatment of benign cystic and fibrocystic diseases of bones. *Jour. Bone & Joint Surg.*, 23: 251, 1925.
8. Lang, F. J. Microscopic findings in bone cysts. *Deut. Ztschr. f. Chir.*, 172: 1–4, (July) 1922, Abstract: *J. A. M. A.*, 79: 1372, 1922.
9. Lotsch, F. Conservative treatment of bone cysts. *Deut. med. Wchnsch.*, 23: 2046, 1920. Abstract: *J. A. M. A.*, 75: 574, 1920.
10. Meyerding, Henry W. Cystic and fibrocystic disease of the long bones. *Am. J. Orth. Surg.*, 16: 253, 1918.
11. Meyerding, Henry W. Cyst of the left femur; cyst of the right femur. *Surg. Clin. N. Amer.*, 1: 1493, 1921.
12. Phemister, D. B., and Gordon, John E. The etiology of the solitary bone cyst. *J. A. M. A.*, 87: 1429, 1926.
13. Santos, Jose V. Bacteriology of apparently normal bones. *Jour. Bone & Joint Surg.*, 28: 150, 1930.
14. Silver, David. The so-called benign cyst of the bones. *Am. J. Orthop. Surg.*, 9: 563, 1911.

ACUTE PUERPERAL INVERSION

J. BAY JACOBS, M.D., F.A.C.S.

Associate Attending Obstetrician, Georgetown University and Garfield Memorial Hospitals; Chief, Georgetown Obstetric Service, Gallinger Municipal Hospital

WASHINGTON, D.C.

THIS condition is referred to as acute if it occurs within a month after delivery. Thereafter it is known as chronic inversion.

When the fundus remains within the external os the inversion is incomplete. A partial or complete protrusion of the fundus through the external os is known as complete inversion. There may be an accompanying prolapse, causing the corpus of the uterus to extend to or through the introitus, governed to a great extent by the degree of laxity of the cervical supports as well as the patulence of the cervix. The vagina may be involved in the prolapse. The cup formed by the completely inverted uterus, will of necessity, contain the tubes and ovaries, broad ligaments, part of the bladder, and possibly omentum and gut. Strangulation of any of these structures may be caused by a constricted cervix.

Inversion is regarded as the rarest obstetric accident and almost always occurs immediately after delivery; although Hypher[1] states that he encountered one that occurred seven days after delivery. Williams[2] stated that many obstetricians had never seen a case; and at the St. Petersburg Lying-in Hospital not a single case had occurred in 250,000 labors. Findley[3] quoted the Vienna Lying-in Hospital as having one case in 280,000; also several authors who had reported none in 200,000 deliveries. Phanauf[4] believes that the condition is becoming less frequent because of improved obstetric teaching, and mentions an incidence of one in 125,000 labors. DeLee[5] states that in 250,000 deliveries Braun did not see a case; and in Dublin one was observed in 190,000 labors. Because of the inferior type of obstetrics practised by midwives, they see more of these cases than the obstetrician.

It is estimated that 85 per cent of inversions are of obstetric origin and 15 per cent due to traction of an intrauterine tumor. Factors involved in the etiology of the former type are an atonic uterus with a patulous cervix. Effort to express a placenta from a uterus that is not contracted, traction on a cord, either because of shortness or being twisted around the fetus, or in an effort to free the placenta, will help to cause inversion. Any increase in intra-abdominal pressure, such as vomiting, coughing or sitting up in bed, may have a similar effect. In 1793 White[6] was called to see a patient with a retained placenta. The patient was standing while the midwife was making traction on the cord. Not meeting with success, the woman was made to cough and sneeze. The midwife then caused her to vomit by tickling her throat while continuing traction on the cord. Except for the etiology, White's description of this case is in so many respects identical with mine, as to again warrant reference to it at an appropriate place in this paper. Rucker[7] regards inversion as analogous to intestinal intussusception; first there is a dimpling of the placental site, then a cupping, and the uterus contracts in an effort to throw out this mass, much as it would a foreign body, thus completing the inversion.

Hemorrhage, shock and pain are the symptoms in their probable order of importance. The hemorrhage may be due to a partial separation of the placenta, or open sinuses of a relaxed uterus, especially at the placental site. Most authors believe that the inversion itself causes shock. Since Rucker[7] was able to invert a uterus by making traction on the cord, and then

while the patient was out of anaesthesia, remove the placenta and replace the uterus without any subjective or objective symptom, he feels that inversion itself does not cause shock, but that it is caused by strangulation. Browne[8] attributes shock to compression of the ovaries in the cervical constriction similar to that produced by the injury of a testicle.

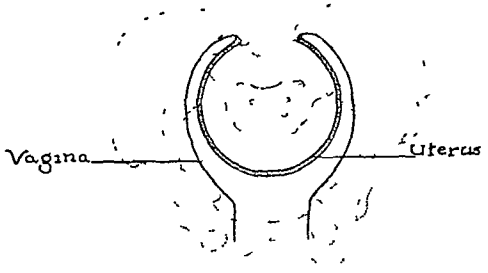


Fig. 1. Shows hand palpating completely inverted uterus.

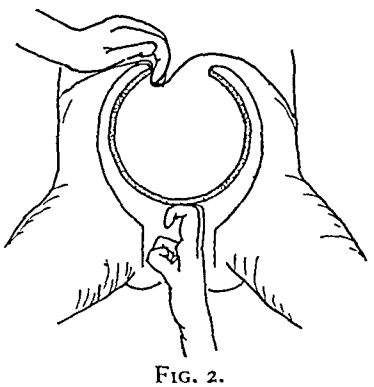


Fig. 2.

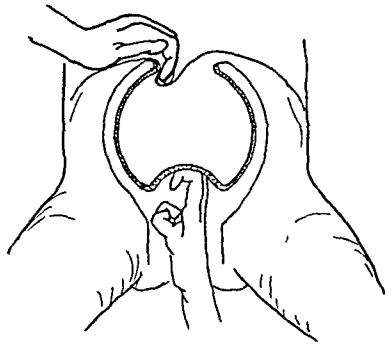


Fig. 3.

Fig. 2. Reduction by taxis. The rim of the uterine "cup" is grasped by the external hand, while upward pressure is made by the flexed index and middle fingers of other hand. Thus perforation of uterus is avoided.
Fig. 3. Uterine body is indented and reduction started.

Time is an important element in treatment. The difficulty of replacement may be regarded as being in direct proportion to the time elapsing since occurrence. Other factors governing action are the amount of hemorrhage and shock. Some authors caution not to replace the fundus during shock, but to pack the vagina around the uterus and treat palliatively. My patient had lost so much blood and was in such extreme shock, that I considered it a lesser risk to act immediately. Transfusions and infusions are of great help at this time. During the process of reduction by taxis, many a uterus has been perforated. Therefore, when the placenta is attached to the prolapsed fundus, if the cervix is not too constricted, it is well to remove the placenta after reducing the inversion, and thus avoid this danger. Should the cervix be constricted or hemorrhage profuse, the placenta had better be removed first. All active treatment should be done under anesthesia. Chronic inversions are now treated by various operative procedures. Since this leaves the uterus with a scar, the patient must receive the same consideration during a subsequent pregnancy as if she had had a previous cesarean section. White[6] suggested the use of a repositor to be used in acute cases, to which reference will be made again. Aveling[9] was successful in reducing a chronic inversion by the use of his repositor.

It is my opinion that recurrence is more apt to be obtained immediately after replacement than at any other time, including subsequent deliveries. Some authors state that recurrence never happens. Although Miller[10] refers to a patient of Emmet who was pregnant five times after

an inversion and never had a recurrence, he says that recurrences occur in 26 per cent of cases in subsequent pregnancies.

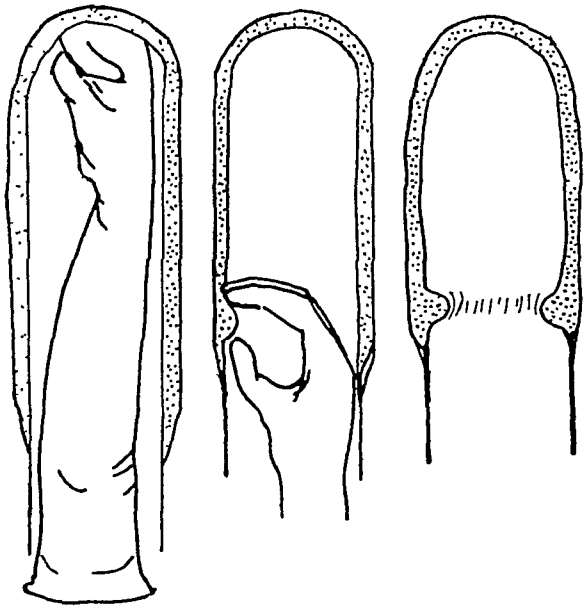


Fig. 4. Fig. 5. Fig. 6.

Fig. 4. Reduction completed. Birth canal greatly elongated and relaxed, resembling a stocking. Fist held in fundus, while external hand massages intervening portion of uterus, to stimulate contraction. Notice absence of cervical rim.

Fig. 5. In trying to locate the cervix, the examining fingers locate a small elevation at one point on the vaginal wall. By "kneading" outward from this point, along a circular course, a continuous soft ridge is made to appear.

Fig. 6. "Kneading" has stimulated the flaccid cervix to appear.

Williams quotes a case where inversion occurred in three successive deliveries.

Again I refer to hemorrhage, shock, and infection for the mortality is due to one or more of these three factors. According to Telfair[11] mortality is 36 per cent; Cooke[12] states 40 per cent; other authors quote between 15 and 70 per cent. DeLee[5] calls attention to Crosse, who in 1843 gathered 109 cases, and of these 80 died. Hypher[1] interestingly describes the cause of death in 2 cases treated by midwives; in one, the fundus was taken to be the placenta and it was pulled off with the adnexa; in the other, the uterus was thought to be a second child and it was pulled off.

Case Report. At 5:40 P.M. on December 24, 1934, Mrs. J. C., a white primipara, was seen in consultation at the Georgetown University Hospital. At 3:45 P.M., following a labor that was normal in all respects, she had delivered a baby weighing 7¾ pounds. The delivery had not been assisted by any pressure on the fundus. A second degree episiotomy had been repaired during the third stage of labor. After a third stage lasting fifteen minutes the placenta had been expressed by the Crede method. No definite hard mass could be felt when massaging the fundus and after rather vigorous massage pressure was exerted and the placenta appeared at the vulva, and was lifted out, for it showed no tendency to deliver itself. She was given 1 c.c. pituitrin and the massage was continued. A contracted fundus could not be felt and the patient bled moderately. At 5:15 P.M. a severe hemorrhage occurred and the patient was in shock; she was extremely pale and listless, rational and seemed to suffer no pain. I massaged vigorously over the normal location of the fundus, but could feel no evidence of it. After giving her 1 c.c. of gynergen

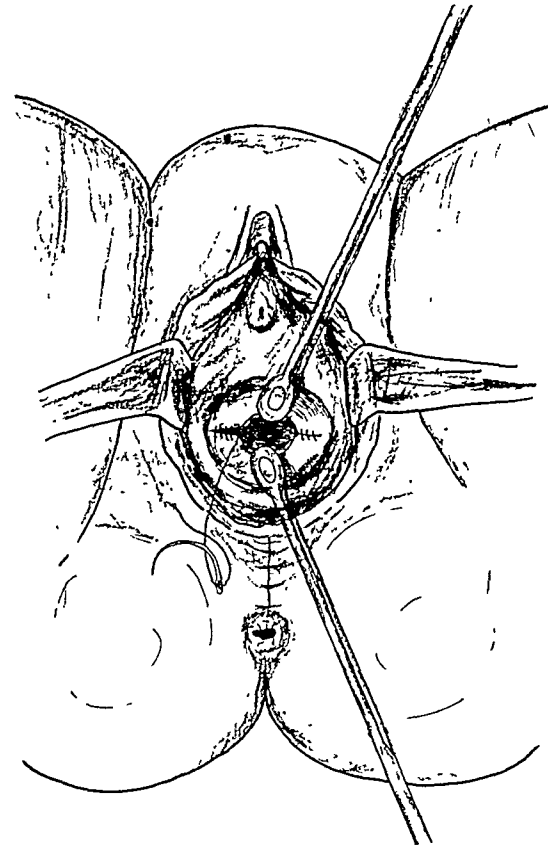


Fig. 7. Cervix brought into view and its lumen diminished to one-third of its size, in order to prevent recurrence when packing is removed.

subcutaneously and 2 c.c. of ergotole intramuscularly, I made pressure over the pelvic region and expressed four large clots about the

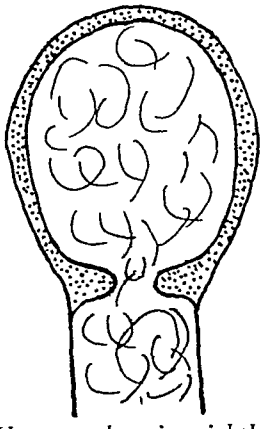


Fig. 8. Uterus and vagina tightly packed.

size of one's fist. At this time the patient's condition was very critical and the pulse not palpable. A transfusion was started and because of shock she was placed in lithotomy position with hips elevated, for uterine tamponade. More clots were removed from the vagina, and a spherical mass about the size of a grapefruit was palpable in midpelvis. (Fig. 1.) It felt very much like a clot, but because of its large size and symmetry, I separated the labia and inspected it. Recognizing the condition, I felt around the top of the mass in an effort to locate the cervix but could feel none. My intention was to reduce by taxis, pushing the upper portion through the cervix first and the lowermost portion last, as advocated by most authorities. This is logical, for in such manner the cervix would be expanded by as small a bulk as possible. Under surgical anesthesia and after hypodermic administration of adrenalin minims 10, this procedure was found to be ineffective, for besides being too hard, the mass was too large to be encircled by my hand. By making upward pressure from below, my external hand was able to feel the upper limit of the mass, with a distinct cupping into which I was able to place my fingers. Steadying the uterus in this manner, pressure was made on the most dependent portion with the tips of the middle and ring fingers. This was soon abandoned for the uterine musculature felt friable. By flexing these two fingers, upward pressure was safely made with the middle phalanges. (Fig. 2.) Suddenly a depression appeared (Fig. 3), into which the tips of several fingers could be placed, following by the entire fist, and gradually the inversion was reduced. The relaxed birth canal was extremely long and appeared like a dilated stocking. (Fig. 4.) The closed fist

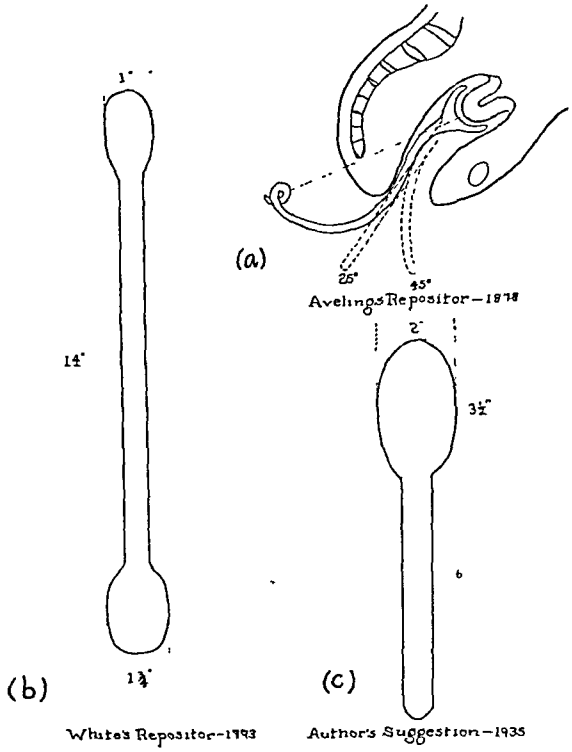


Fig. 9. (a) The repositor with which Aveling was able to reduce a chronic inversion. His model is an improvement on the two represented in dotted lines, since its force is supposedly applied perpendicular to the plane of the inlet. (b) White's repositor, for acute puerperal inversion. Either end may be applied to the lowermost portion of uterus and upward pressure made. (c) Author's suggestion for reduction of acute puerperal inversion by taxis. This device is made of wood and is ordinarily used for darning stockings.

was held in the uppermost portion for several minutes, while the external hand massaged the intervening portion of uterus in an attempt to stimulate contraction. There was no response. It was decided to pack the uterus, for any intra-abdominal pressure could have caused a recurrence. Usually in performing uterine tamponade, my left hand reaches the cervix and acts as a guide for the packing, which is inserted by my right hand with the aid of dressing forceps. Surprisingly, this could not be accomplished because of the unusual length of the birth canal. My intention now was to bring down the cervix, but it had relaxed to the extent that there was no demarcation between the uterus and the vagina. Finally, a small soft ridge was felt in the anterior vaginal wall

(Fig. 5); this was grasped and gently kneaded with the fingertips. Gradually more and more of this circular elevation could be outlined. (Fig. 6.) The anterior and posterior portions of the ridge were grasped with sponge forceps and brought into view. (Fig. 7.) The cervix was soft, about ⅜ inch thick and markedly dilated. Both sides were sutured with a continuous suture of No. 2 plain catgut, thus reducing the lumen to about one-third of its original size. To prevent partial prolapse and hemorrhage, six yards of gauze, thirty-six inches wide were placed in the uterus and two yards in the vagina. (Fig. 8.) Treatment for shock was instituted with improvement immediate in the appearance and the general condition, pulse was 140 and easily felt. Twenty-four hours later 1 c.c. pituitrin was given by hypodermic and packing removed. Recovery was uneventful.

In a reviewal of the literature I found only one case in which the cervix seemed to have disappeared, the case reported by John White[6] in Medical Commentaries in 1795 and to which reference has already been made. He, too, kneaded the vaginal wall with his fingers until he was able to feel a ridge of cervix, and then proceeded in the manner I have described. At the time that my fingertips began to perforate the uterine wall in attempting taxis, I visualized a simple devise here depicted (Fig. 9), which is ordinarily intended for darning stockings, and would have facilitated my attempt very much. Strangely enough, White in his report, suggests a similar apparatus (Fig. 9), namely a round stick of wood, 14 inches long, and expanded and padded at each end, to avoid trauma, one end measuring one inch in diameter and the other, 1¾ inches. Either end could be used for taxis.

From an analysis of the case presented, several deductions may be made.

1. Pressure should not be made on a fundus unless it is contracted.

2. If immediately after delivery the fundus is not palpable as a hard mass in its usual location, inversion should be suspected.

3. In any case of severe hemorrhage or shock after delivery, vaginal examination should be made.

4. In controlling postpartum hemorrhage by tamponade, do not pack the vagina only, but locate the cervix and pack the uterus. In this manner an existing inversion or a lacerated cervix would be discovered.

5. Extreme care should be exercised in removing clots from the vagina.

6. Shock appears to be relieved immediately after replacement; therefore cautious attempt at early reduction should be done.

7. Many cases probably go unrecognized. They are regarded as postpartum hemorrhage and if death occurs it is attributed to this cause. Otherwise the inversion may not be detected until it becomes chronic.

8. For this reason the incidence is probably greater than that reported in the literature.

9. The suggestion of diminishing the lumen of the cervix to prevent recurrence is presented as a contribution to the treatment of this condition.

REFERENCES

1. Hyper, N. *Brit. M. J.*, Lond., 2: 179, 1930.
2. Williams, J. W. Obstetrics, 6th Edition, N. Y., D. Appleton & Co., 1930, 1015–1017.
3. Findley, P. *Am. J. Surg.*, 3: 452–455, 1927.
4. Phanauf, L. E. *Surg., Gynec. Obst.*, 48: 701–711, 1929.
5. DeLee, J. B. Principles and Practice of Obstetrics, 5th Edition, W. B. Saunders Co., Phila., 1928, 841–845.
6. White, John. Medical Commentories. Decade 2, 10: pages 247–252, 1795.
7. Rucker, M. P. *N. Eng. J. Med.*, 205: 22–23, 1931.
8. Browne, F. J. *Prac. Roy. Soc. Med.*, Lond., 24: 1625, 1931.
9. Aveling, J. H. Tr. Obst. Soc. Lond., 20: pages 126–130, 1878.
10. Miller, N. F. *Am. J. Obst. and Gynec.*, 13: 307–322, 1927.
11. Telfair, J. H. *N. Y. Med. Jour.*, 99: 882, 1914.
12. Cooke, W. P. Obstetrics and Gynecology, Curtis, Phila., W. B. Saunders Co., 1933, vol. ii: 176.

ACUTE DILATATION OF STOMACH

WITH REPORT OF A CASE*

H. JACKSON KING, M.D.

Surgical Service, Binghamton City Hospital

BINGHAMTON, N. Y.

IT is the purpose of this paper to sketch briefly the concepts held regarding acute dilatation of the stomach, and to report and discuss a case of this kind, recently seen, which is unique in its etiology and offers many points of interest and instruction.

All surgeons of experience are familiar with acute gastric dilatation as a postoperative occurrence. It has been said that practically every abdominal operation involving extensive stimulation of visceral afferent nerves is followed by a degree of gastric relaxation. A considerable number of the reported cases followed operations under general anaesthesia, and a fair estimate would be that 60 to 70 per cent of the cases are postoperative in their origin. Acute gastric dilatation has also occurred following fractures, injuries to the spine and skull, blows to the abdomen, after catheterizing bladder or ureters, and complicating peritonitis. The German literature contains an unusual case which complicated a floating spleen.

In medicine it has been seen during convalescence from wasting diseases and has frequently complicated serious illnesses as pneumonia, typhoid, tuberculosis, diabetes and uremia. It has not been unusual to encounter it following difficult childbirth. Finally, it has been reported following excessive intake of food or drink in persons who were apparently in normal health.

Dragstedt has conducted a thoroughly scientific and very illuminating study into the pathology, physiology, and mechanics of this syndrome. His work represents probably the most valuable recent contribution to this subject.

The pathology in these cases is limited to the stomach which is tremendously dilated with gas or a mixture of gas and blackish colored fluid, and the transverse portion of the duodenum which is commonly found to be compressed at the point where the mesentery and superior mesenteric vessels cross it.

Physiologically the stomach is, like the heart, an automatic organ. In addition to its intrinsic nerve supply it receives fibers from the vagi which are predominantly motor to the stomach proper, but inhibitory to its sphincters; and fibers from the splanchnics which conversely are inhibitory to the stomach, but motor to its sphincters. A long chain of experimental evidence proves that stimulation of either splanchnic or somatic sensory nerves may produce inhibition of gastric tone through a reflex stimulation of the splanchnic, and inhibition of the vagus, nerves to the stomach.

The weight of evidence favors the theory that acute gastric dilatation is primarily of neurogenic origin. The factor of duodenal compression is quite clearly secondary, both in sequence and in importance, being produced most commonly by downward traction on the mesenteric root caused by the displacement of intestinal loops into the pelvis. Its significance in the syndrome however is real and lies in the fact that any obstruction to the intestinal channel, no matter how slight, probably offers a serious obstacle to an atonic, feeble stomach and duodenum.

Dragstedt's results in experiments on gastric and pancreatic secretion in dogs show clearly that our estimates for normal

* From the service of Dr. Wm. A. Behan.

secretion from these organs have probably been entirely too conservative, and that even under conditions of continued gastric stasis, such as are present in cases having prolonged gastric dilatation, the phenomenally large quantity of accumulating fluid is in reality but little more than that which is secreted into the upper alimentary tract under normal conditions. However, it is the inability of the atonic alimentary tract to transport these stomach and duodenal secretions into the absorbing lower portions of the intestinal tract, and the consequent continued loss to the blood of the ions sodium and chloride, which represent the major pathogenic factors in these cases of prolonged gastric dilatation.

CASE REPORT.

This case of acute dilatation of the stomach falls within the group of 30 to 40 per cent which are termed non-postoperative in origin. It is a classical example of the condition and illustrates very graphically the mechanisms that are active in the early stage of gastric dilatation, before the secondary factors of fluid loss and blood chemistry change enter the picture. The etiology and clinical course of this unusual case appear to be without parallel in the literature.

The patient, a sixty year old housewife, was brought to the hospital by ambulance about 9:00 P.M. She was suffering most excruciating abdominal pain, and the history of her illness was obtained with great difficulty. It was learned that during the previous ten years she had been troubled by rather frequent attacks of abdominal distension, noticed soon after taking food, which would persist until she had raised gas. Belching relieved the ordinary attacks but occasionally she had found it necessary to induce vomiting in order to ease her stomach.

The morning of admission her bowel moved normally. A little later she noticed slight epigastric distress which became more pronounced by noon. She ate quite heavily and by three o'clock felt uncomfortable and bloated. Repeated attempts to belch gas failed to relieve her, and toward evening she noticed that her abdomen was definitely increasing in size. By this time the discomfort had become a constant with severe pain throughout the epigastrium. She tried to vomit but without success. At about 8:00 that evening she was found suffering intense pain, her abdomen tremendously distended and rigid. She was given about one grain of morphine sulphate hypodermically and was hospitalized immediately.

When seen at the hospital at 9:00 P.M. she was in a sitting position in bed, writhing from side to side and alternately moaning and screaming with pain. Temperature was 97.6°F., pulse 140, and respirations 28. The abdominal distension was greater than that of a full term pregnancy. The abdominal wall was tense and drum like and examination failed to reveal either palpable or auscultable peristalsis and was tympanitic throughout. Sharply demarcated at the level of the umbilicus, the entire lower half of her body was deeply cyanotic and cold. The perineum was bulging and the rectal mucosa had prolapsed from the tremendous intraabdominal pressure.

An attempt was made at once to pass a stomach tube but obstruction was encountered at the lower end of the esophagus and nothing was obtained. A soap suds enema was given without result. A second unsuccessful attempt was made to pass a stomach tube. The pain ostensibly was terrific and severe shock appeared imminent. It was decided to give morphine sulphate ¼ grain intravenously. The effect was profound. The screaming ceased almost immediately and within fifteen minutes respirations became so slow that continuous carbon dioxide-oxygen mixture and stimulants had to be administered in order to resuscitate her. In an hour her respiration was considered satisfactory. About 250 c.c. of 10 per cent dextrose solution were given intravenously and at midnight she was taken to the operating room in a quiet but not stuporous state, but with a very rapid and weak pulse.

Under spinal anaesthesia a right rectus exploratory incision was made. The abdominal wall was found to be very thin and relatively bloodless due to the tremendous distension. As the abdominal cavity was entered an extremely large, pale, tense structure was encountered which had the appearance of a huge cyst, but proved to be a greatly dilated stomach, extending from the ensiform cartilage

down to the pelvic brim. A trocar and cannula were inserted through its anterior wall in order to decompress it. An enormous amount of gas and a small amount of clear fluid were very gradually withdrawn through the cannula, care being taken to decompress the viscus slowly. The stomach was then identified as a large, atonic organ with numerous folds, very ischemic in appearance, but nowhere gangrenous. A small area of hemorrhage was found in the pre-pyloric region. The pylorus itself appeared definitely stenosed, and was the site of an old healed ulcer. The remainder of the bowel was normal. A hasty exploration failed to disclose any pathology of the other abdominal organs, and since the patient's condition was steadily growing worse, an enterostomy was performed quickly using a loop of jejunum. The abdomen was then closed in layers.

The patient was in deep shock at the conclusion of the procedure and died about twenty minutes later. Autopsy was performed eight hours post mortem. The more important points from the pathological report of Dr. Victor W. Bergstrom are quoted.

"The abdomen was markedly distended. The stomach and small bowel were tremendously dilated. The stomach appeared large enough to hold three or four quarts. The whole alimentary tract was considerably injected. There was no peritonitis—no free fluid. No inflammatory process could be found anywhere except in the lower border of the pancreas. In the tail were two areas of hemorrhage. One was about 1.5 cm. in diameter apparently involving the parenchyma, and another about 0.5 cm. in diameter. The gall bladder contained a large stone.

"The biliary tract was carefully examined. The pancreatic duct entered the common duct about 1½ cm. above the ampulla of Vater. All of the ducts appeared to be patent.

"The pylorus showed an old, healed ulcer in the serosa. On the mucosal surface of the ulcer no mucous membrane could be found. The pylorus could not be dilated more than to admit the tip of the little finger.

"Macroscopic Diagnosis—Hemorrhagic pancreatitis; Adynamic Ileus; Acute gastric distension; Old healed ulcer of pylorus.

"Microscopic examination of the pancreas shows very extensive areas of glandular necrosis with areas of interstitial hemorrhage. The condition is antemortem because the hemorrhage is old, having laid down quantities of blood pigment which are being phagocyted. There is slight perivascular and periductal, small, round cell infiltration. Blood vessels are sclerotic and some of them are completely occluded. Occlusion of blood vessels is noted very particularly in one of the necrotic areas.

"The pylorus shows an ulcer of not very great age. The base is not yet completely healed and is covered by a thin, organizing membrane. The gall bladder shows too much postmortem autolysis for pathological and histological changes to be identified.

"Microscopic Diagnosis—Acute pancreatic necrosis. Peptic ulcer of pylorus."

DISCUSSION

Considerable uncertainty was felt regarding the correct diagnosis in this case. Some thought that the perforation of a peptic ulcer might account for the clinical picture, others that the gall bladder might contain the underlying pathology. Only one man made an unequivocal diagnosis of acute pancreatitis.

More consideration should have been accorded the syndrome of acute pancreatitis. In the fulminating type it is very often attended by severe neurogenic shock such as this patient showed; cyanosis, rapid pulse, falling blood pressure, subnormal temperature, and collapse often being encountered. Moreover, agonizing and unremitting upper abdominal pain is perhaps the most typical single symptom of this disease.

It is purely conjectural to attempt to evaluate the importance which each factor in this case had in producing the acute dilatation of the stomach. That the old, partly healed pyloric ulcer had a definite part is more than likely, but alone it could not possibly have been responsible for the tremendous splanchnic shock which resulted in the profound loss of gastric motor function. It seems probable that the sequence of events was something as follows. The narrowing of the pylorus caused by the healing of the ulcer was so gradual in development that the compensa-

tory hypertrophy and increasing motility of the stomach were still successful in forcing gastric contents into the intestines. However, the rather frequent occurrence of epigastric distension, occasionally requiring vomiting for relief, indicates that at times the obstruction must have been quite marked. Very probably the onset of the attack of acute pancreatic necrosis inhibited gastric motor function so strongly through reflex splanchnic stimulation that the enfeebled peristalsis was no longer able to force gas and fluid through the pylorus. In belching to relieve her distress the patient swallowed air some of which became trapped in her stomach. Dilatation of the stomach began and increased steadily as more air was swallowed. It was inevitable that duodenal compression should occur. The distending stomach forced the small intestines down into the pelvis so that traction on the mesentery produced compression of the transverse duodenum in the manner that has been previously described.

Fluid and perhaps gas may have regurgitated from the small bowel into the stomach to add to the distension. However, gas in the quantity that was present in this case could only have accumulated so rapidly by being swallowed and retained in the stomach. This occurs not uncommonly during violent efforts to raise gas and to vomit. Whether our failure to pass the stomach tube was due to cardiospasm, which is one of the results of splanchnic stimulation, according to Dragstedt, or to an obstruction caused perhaps by a kinking of the lower esophagus incident to the tremendous dilatation of the stomach below it, unfortunately was not determined at autopsy.

SUMMARY

The common causes of the syndrome of acute dilatation of the stomach have been reviewed and its physiology briefly discussed.

A case of acute dilatation of the stomach has been presented which appeared to have a combined pancreatic and duodenal pathology as its main etiology.

REFERENCES

Dragstedt, L. R. and Dragstedt, C. A. Acute dilatation of the stomach—*J. A. M. A.*, 79: 612, 1922.

Dragstedt, L. R. and Ellis, J. C. Fatal effect of total loss of gastric juice—*Proc. Soc. Exper. Biol. & Med.* 26: 305, 1929; *Am. J. Physiol.* 93: 407, 1930.

Dragstedt, L. R., et al. Pathogenesis of acute dilatation of the stomach—*Surg. Gynec. and Obst.* 52: 1075 (June) 1931.

Scalone, I. Acute dilatation of the stomach due to floating spleen, and research on duodenal occlusion —*Clin. Chir.* 31: 3 (January) 1928.

GANGRENE OF LUNG

J. K. DONALDSON, M.D. AND EDGAR McPEAK, M.D.

Associate Surgeon, Robert B. Green Memorial Hospital; Visiting Surgeon, Nix and Santa Rosa Hospitals

Visiting Physician, Santa Rosa and Nix Hospitals

SAN ANTONIO, TEXAS

IN 1932 Israel reported a case of gangrene of the right lung in which he called particular attention to the extensiveness of the disease, stating that, "The postmortem, recorded below, describes a pulmonary gangrene that involved an entire lobe of a lung which I have been led to believe—judging from the paucity of published instances—is an extremely uncommon occurrence."[10]

We report here a case in which the entire lower lobe and half of the middle lobe of the right lung were liquified and passed by mouth over a period of three weeks dating from the onset of the condition until death.

True gangrene of the lung because of its rarity accounts in part for our incomplete understanding of the etiological and pathological types. A definite advance has been made in the therapeusis of localized pulmonary abscesses, but the mortality in actual gangrene of the lung is almost 100 per cent. The status of surgical accomplishments of the chest is now such, however, that a lowering of the mortality of pulmonary gangrene may perhaps be expected from surgical quarters providing criteria for early diagnosis and proper entity classification, may be successfully established.

A considerable amount of experimental work has been done upon the production of pulmonary suppurations. Kline and his coworkers, Lambert and Weeks,[13] and others deserve considerable credit for the efforts they have made in their etiological investigations. Kline feels that he has made some progress in the treatment of gangrenous suppurations by intravenous neoarsphenamine injections.[12] While the exact status of the frequency with which spirochetal organisms play in gangrene has not been as yet fully settled, it may be that these organisms are, at least in some instances, of considerable etiological importance. Fungi, it should also be remembered, may at times be either primary or secondary factors. Lambert and Weeks and others stress the potential importance of certain anaerobes.

Those predisposing factors such as emboli, upper respiratory injuries whether accidental or therapeutic, pulmonary disease and stasis, and factors relative to the patient's general well being, are fairly well known. The flat position for tonsillectomy, careful pre and postoperative attention to mouth hygiene, the consistent turning of the patient from side to side when permissible postoperatively, anesthesia carefully selected and given with good apparatus by an expert, are a few details which are neglected too often simply because complications resulting from a certain degree of their abuse are either minor or rare.

If an actual pulmonary gangrene is not rapidly checked or promptly started upon a course of localization by arsphenamine or massive iodide injections, radical surgery seems to be the treatment of choice providing there is no insurmountable contraindication.

In 1922, in a masterful article on lung surgery, Lilienthal stated that, "If operable pulmonary suppuration were as common as gangrenous appendicitis, surgeons would learn how to deal with it; and I may say by the same means, extirpation."[17] Babcock, considering gangrene of the lung, states "Recovery is rare without opera-

tion," and discusses briefly "pneumotomy and free drainage."

For the patient of this report, extensive surgery was considered early in the course, when the diagnosis of pulmonary gangrene was made. Had there been less concomitant pathology most probably partial or complete cautery extirpation of the gangrenous area, or extensive pneumotomy with valved drainage, would have been attempted. Besides the more extensive surgical measures we considered pneumothorax, pleural lavage, bronchoscopy, neosalvarsan therapy and antitoxin injections. These procedures were all discarded; in view of the excellent drainage which the patient seemed to be getting by mouth we decided to cast his lot with extreme conservatism feeling that some localization and immunity might possibly intervene.

Present Illness. C. V., age twenty-three, an electrician, was admitted to the Medical Arts Hospital at 2:45 A.M., April 10, 1935, following an automobile accident at 1 A.M. The patient, who was driving, was thrown from the car. Momentary unconsciousness was attained. He had not been drinking and all history otherwise was irrelevant or negative.

Physical Examination. The patient was almost perfect physically before his accident, weight 185, height 5 feet 11½ inches. On admittance, shock was moderate; blood pressure 100/80; pulse 96; respiration 18. Morphine and first aid had been administered before admittance. He was conscious and cooperative.

Head and face injuries constituted a 3 inch laceration of the scalp down to the skull in the right frontal area, contusion and swelling of the entire face; a complete transverse fracture of the left ramus of the mandible and a comminuted fracture of the mandible in the region of the right mental foramen. Very little injury to the soft parts of the mouth or the teeth was present. A break in the continuity of the gums with mild secondary infection developed at the area of the latter fracture. No discolorations, tender areas, or pathological signs or symptoms of the soft or bony parts of the chest could be elicited by clinical and roentgenological examination, with the exception of a slight general tenderness around the lower lateral part of the right chest. In its upper third the right leg presented a severe compound comminuted fracture of the tibia and fibula involving 4 inches of the bones and soft tissues. The right fibula also presented a transverse comminuted fracture in it's lower third. Considerable venous hemorrhage was prone to occur from the leg wound. Except for minor contusions and lacerations, the rest of the examination was negative.

April 10, 1935, 9:00 A.M., permanent control of hemorrhage, debridement of the leg wound with open reduction of the upper leg fractures, placement of wires for the mandibular fractures, suture of the scalp and minor dressings were done. The mandibular wires were not tightened until later for fear of possible aspiration of vomitus. Gas, oxygen and ether anesthesia was administered and the lungs were thoroughly washed with oxygen and carbon dioxide on completion. The post operative condition was good. The patient was shifted through a 22⅓° angle from side to side every hour for the first six hours and every one and one-half hours the following six hours, and occasionally thereafter. April 12, 1935, 4:10 P.M., for first time he complained of rather severe aching pain in the right kidney region. April 13, 1935, 9:00 A.M., temperature 101.6°; pulse rate 112; respiration 24; general appearance good. April 16, 1935, complaining of sharp pain in right chest and back and some nonproductive cough. At 8:00 P.M. the axillary temperature was 104°; respiration 28; pulse 112; some moderate dimunition of the breath sounds at the right base. These were the first definitely abnormal objective chest findings. April 21, 1935, cough became increased with offensive breath. At 11:25 P.M., he began to cough hard with offensive odor; raised and swallowed some production. Breath sounds were much decreased at the right base, with a few crepitant rales heard. April 22, 1935, at 1:00 A.M., increasing dosages of narcotic became necessary to control spasmodic cough. The stench of the breath was more marked. His general appearance was fair. The diagnosis was made of suppurating gangrenous pocket with infection of possible fulminating nature. Blood count at 2:00 A.M. showed a total white count of 20,300 cells; polymorphonuclears 91 per cent; segmented 67 per cent; stabs 21; juveniles 2; lymphocytes 8 per cent; basophiles 1 per cent; monocytes 1. There was no eosinophiles,

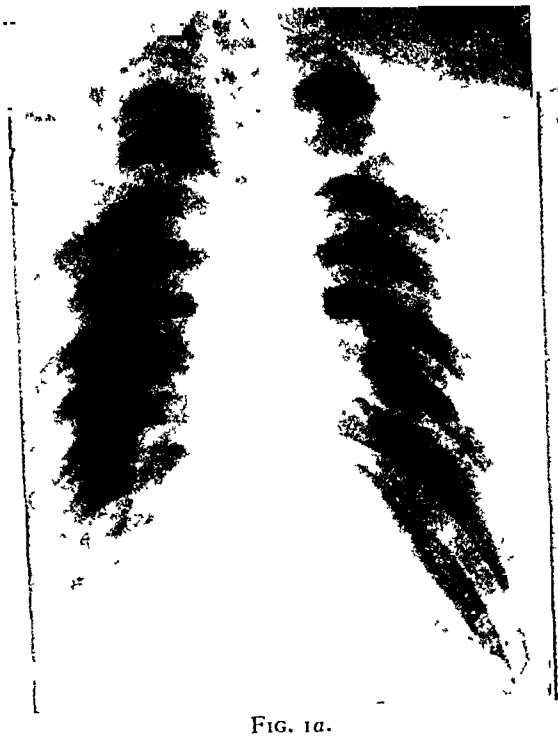


FIG. 1*a*.



FIG. 1*b*.

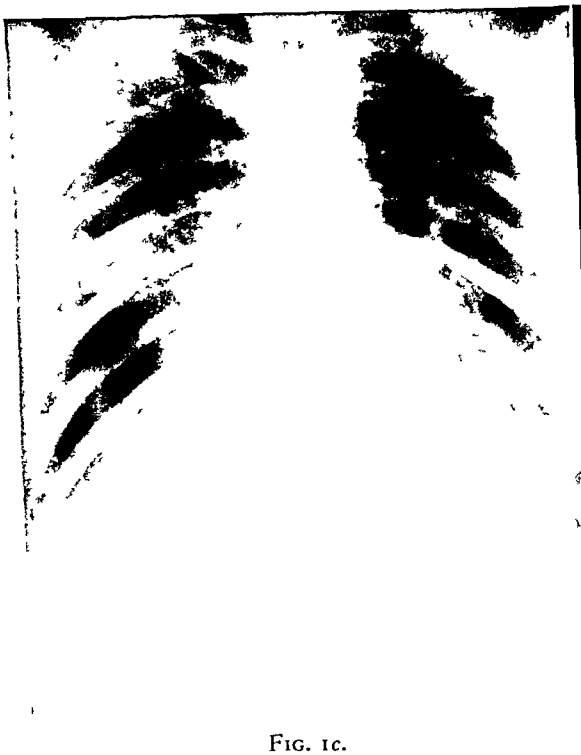


FIG. 1*c*.



FIG. 1*d*.

FIG. 1. Embolic infarction from a fracture site was promptly considered as the possible etiological factor in the developing pulmonary condition. We believe however, that the etiological factor was an aspiration affair. It should be noted that the orthodontist had considerable trouble keeping the mandibular fractures properly immobilized.

The plates were taken on the following dates: (*a*) April 12; (*b*) April 17; (*c*) April 29; (*d*) May 6, 1935.

myelocytes or normoblasts. Roentgenological and other opinions varied regarding the degree and type of pulmonary infection. Dr. Edgar



Fig. 2. The lower lobe and the anterior half of the middle lobe of the right lung had been liquified and passed by mouth. The depression shown in the upper lobe was caused by pressure used in preservation of the specimen.

McPeak suggested heavy doses of iodides in consideration of possible fungus invasion. The possibilities and accomplishments which radical surgery offered were considered, but conservatism with intravenous iodide injections was instituted.

April 23, 1935, the breath sounds were practically absent over anterior right base, otherwise the chest findings were essentially negative. On general appearance he seemed to be holding up well. He was raising and swallowing large amounts of sputum. April 30, 1935, 11:00 A.M., the blood count showed total white cells 8,400; polyphocytes 83 per cent; segmented 31 per cent; stabs 27; juveniles 5 per cent; lymphocytes 13 per cent; monocytes 2 per cent; myelocytes 2 per cent; no eosinophiles, basophiles or normoblasts. At 8:00 P.M., his temperature was 100.6, pulse 84, fairly strong and regular; respiration 22; and general appearance fair. May 6, 1935, he appears emotionally depressed and is expecting death. Fully rational, cooperative, pulse strong and regular. Chest aspirated; 60 c.c. of thin odorifirous pus obtained. In cases of this type the danger of cellulitis has been mentioned repeatedly. There was a definite variance of opinions among the consultants as to its advisibility in this case. May 8, 1935, brawny swelling developing from right axilla to below crest of ileum. May 10, 1935, from 8:00 P.M. to 4:15 A.M., morphine gr. 5.5 with 2 HMC's, did not effectively control cough. He was fully conscious almost until the immediate time of exodus, fully cognizant for hours of approaching death. The racking cough which persisted for days was the single subject of his pitiful complaint.

Laboratory Findings: It is not essential to report all blood counts, transfusions and urine analyses which were done. Some difficulty was experienced in obtaining sputum specimens because of the mandibular wiring. Most of the sputum raised was swallowed. In the specimens studied no spirochetes, fusiform bacilli or fungi were seen. Culture by Dr. R. E. Scott on Sabourraud's media showed no fungi. Smear showed pus cells, lymphocytes, a few pneumococci like organisms, short chained streptococci, and several clumps of staphylococci. Cultures directly from the involved lung at autopsy showed a very small feebly hemolytic staphylococcus albus. (Dr. Scott.)

Autopsy: The upper right lobe and the portion of the middle lobe remaining, except for the immediate area of the advancing gangrenous process, were grossly negative. The left lung showed some scattered areas of congestion. The line of advancing gangrenous involvement seemed to be confined to a margin less than 0.5 cm. in thickness; the lung tissue beyond this thickness was not infiltrated but the lung tissue behind this advancing margin was completely liquified and disintegrated. The interior of the right chest wall and the mediastinal chest surface were extensively involved in fibrinous, inflammatory reaction. Bits of pleura and an occasional small tag of old lung tissue were adherent to the chest wall and diaphragm. A thick fibrous exudate covered the thoracic aspect of the diaphragm. The hepatic side of this structure was absolutely free from inflammatory reaction. About 500 c.c. of thin pus was present in the chest cavity, apparently the result of the physiological terminal stage. The entire lower lobe and half of the middle lobe of the right lung had been destroyed by an

odorifirous, gangrenous process. There was a thick brawny swelling involving the skin and tissues of the right chest wall from below the crest of the ileum to and including the right axilla. The leg fracture sites presented no evidence of any infection. Moderate infection was evident at the site of the right jaw fracture.

SUMMARY

1. The rarity of pulmonary gangrene accounts partly for our incomplete understanding of etiological and pathological types. All cases should be reported in detail in order that improvement in classification and treatment may continue.

2. The mortality in spreading gangrene of the lung is practically 100 per cent. With our present limitations, extirpation, probably of the cautery type, seems promptly indicated if the condition does not respond rapidly to neosalvarsan or massive iodide therapy.

3. Uncontrollable cough produced pitiful and prolonged suffering in our case. Marked stench of the breath, a good general appearance of the patient long after the blood picture became very alarming and roentgenological findings, were other interesting features.

Drs. John A. Rowe and Franz W. Stumpf handled the orthodontia procedures in this case.

REFERENCES

1. Alexander, John. Pneumectomy and lobectomy. (Editorial) *Surg. Gynec. and Obst.*, 60: 6: 1146 (June) 1935.
2. Alexander, John. Observations on total pulmonary lobectomy and pneumonectomy. *Ann. Surg.*, 101: 1: 393 (Jan.) 1935.
3. Archibald, E. A consideration of the dangers of lobectomy. *J. Thoracic Surg.*, 4: 335, 1935.
4. Bohrer, J. V. Lobectomy for bronchiectasis in children. *J. Thoracic Surg.*, 4: 352, 1935.
5. Brunn, Harold. Surgical principals underlying one stage lobectomy. *Arch. Surg.*, 18: 1: 490, 1929.
6. Crowe, S. J. and Scarff, J. E. Experimental abscess of lung in dog. *Arch. Surg.*, 16: 176, 1928. (Lambert and Weeks.)
7. Cutler, E. C. and Schlueter, S. A. *Ann. Surg.*, 84: 256, 1926. (Lambert and Weeks.)
8. Graham, E. A. The treatment of pulmonary suppuration. *Ann. Surg.*, 86: 174, 1927.
9. Ghiron, V. and Maddalena, P. *Bull. e atti. d. r. accad. med. di Roma.*, 53: 302, 1927. (Lambert and Weeks.)
10. Israel, Leon S. A case of pulmonary gangrene causing pneumothorax and massive subcutaneous pneumatocele. *International Clinics*, 3: p. 46 (Sept.) 1932.
11. Kline, B. S. Pulmonary abscess and pulmonary gangrene. *J. A. M. A.*, 90: 25: 2008, 1928.
12. Kline, B. S. and Berger, S. S. Spirochetal pulmonary gangrene treated with arsphenamines. *J. A. M. A.*, 85: 19: 1452, 1925.
13. Lambert, A. V. S., and Weeks, Carnes. Experimental production of abscess of the lung. *Arch. Surg.*, 18: 1: 516, 1929.
14. Lewis, J. M. and Barenberg, L. H. Pulmonary gangrene due to spirochetes and fusiform bacilli. *Am. J. of Diseases of Child.*, 37: 2: 351, 1929.
15. Lezius. Cure of chronic pulmonary gangrene by removal of a lobe of a lung. *Zentralbl. f. chir.*, p. 531, 1935. (Not reviewed.)
16. Lilienthal, Howard. Carcinoma of the bronchus, suppurative pneumonitis and bronchiectasis, interlobar empyema. *Am. J. Surg.*, 27: 1: 51 (Jan.) 1935.
17. Lilienthal, Howard. Resection of the lung for suppurative infections with a report based on 31 operative cases in which resection was done or intended. *Ann. Surg.*, 75: 3: 257, 1922.
18. Mathes, Mary E. and Holman, Emile. Postoperative pulmonary complications, a review of the literature of 1932–1933. *Int. Abst. Surg.*, p. 105 (Aug.) 1935.
19. Smith, D. T. Experimental aspiratory abscess. *Arch. Surg.*, 14: 231, 1927.
20. Weinberger, M. Gangrene of lung, diagnosis and therapy. *Wien. klin. Wchnschr.*, 47: 308, 1934. (Not reviewed.)

VOLUNTARY DISLOCATION OF NECK

UNILATERAL ROTATORY SUBLUXATION OF THE ATLAS

ERNEST A. BRAV, M.D.

PHILADELPHIA, PA.

SPORADIC reports of unilateral rotatory dislocation and subluxation of the atlas have appeared in the medical literature since the latter part of the Eighteenth Century. The condition is characterized by a forward and medial displacement of one articulating facet of the atlas upon the corresponding facet of the axis around the odontoid process, the opposite atlanto-axial joint remaining within the limits of normal apposition. The displacement may be either partial or complete but is rarely associated with neurologic manifestations. Malgaigne,[1] in 1855, described the condition in detail, noting the incidence of two separate etiologic factors, namely trauma and tuberculosis of the atlas or axis. Walton,[2] in 1892, reviewed a series of cases of rotatory dislocation of the atlas without paralysis, demonstrating that the unilateral character of the displacement minimized the possibility of injury to the spinal cord. Corner,[3] in 1907, gave considerable impetus to the study of this previously little recognized condition when he analyzed 20 cases, including 2 of his own, and explained the mechanism of rotatory displacement of the atlas. Since that time similar cases have been reported by Mixter and Osgood,[4] Ogilvy,[5] Ranzi and Vogl,[6] Jackson,[7] Langworthy,[8] Greeley,[9] Coutts,[10] Brookes,[11] Hudson[12] and others. Increasing recognition of the condition is attested by the frequency of these reports within the past few years.

In each reported instance of atlanto-axial displacement, the condition has been accidental, the result of trauma, disease or congenital malformation. The writer has recently observed a case in which the displacement was entirely under the control of the patient, a voluntary unilateral rotatory subluxation of the atlas on the axis. Because of its unusual nature and its medico-legal possibilities, this case is considered sufficiently important to record herewith.

ANATOMIC CONSIDERATIONS

The odontoid process of the axis projects upward through the ring of the atlas. It articulates with the anterior arch of the atlas in front by means of a true joint, and is bounded on either side by the lateral masses of the atlas and posteriorly by the strong transverse ligament. The atlanto-axial joints, permitting normal rotation of the atlas around the odontoid process, are located on the inferior surfaces of the lateral masses of the atlas and on the superior surface of the body of the axis. The facets of the atlas look downward and inward while those of the axis look upward and outward. The joint surfaces are nearly plane, but there is a slight convexity of the facets of the atlas and a corresponding cancavity of the axial facets. This anatomical structure predisposes to joint instability. In addition to the transverse ligament which bridges the atlas between the odontoid process and the spinal canal, the anterior and posterior atlanto-axial ligaments, the lateral and median check ligaments between the odontoid process and the occiput, and the capsular ligaments assist in maintaining the integrity of the atlanto-axial joints. While there is a definite rocker action at the atlanto-axial joints, the function of these joints is chiefly rotatory. This necessitates a laxity of the joint capsules in order to permit normal motion. Therefore, despite the powerful ligamentous support in the atlanto-axial region, a large part of the burden of resistance to excessive rotatory strains is thrust upon the muscles of the neck. Severe

trauma may prove too much for these muscles and rotatory dislocation with or without fracture may result. On the other hand, very mild trauma, if applied suddenly, may catch these muscles "off guard" so that no protection is afforded the relaxed capsules and rotatory dislocation ensues. Furthermore, any congenital abnormality or pathologic state affecting either the joint structures themselves or the balance of the cervical musculature may give rise to atlanto-axial displacement.

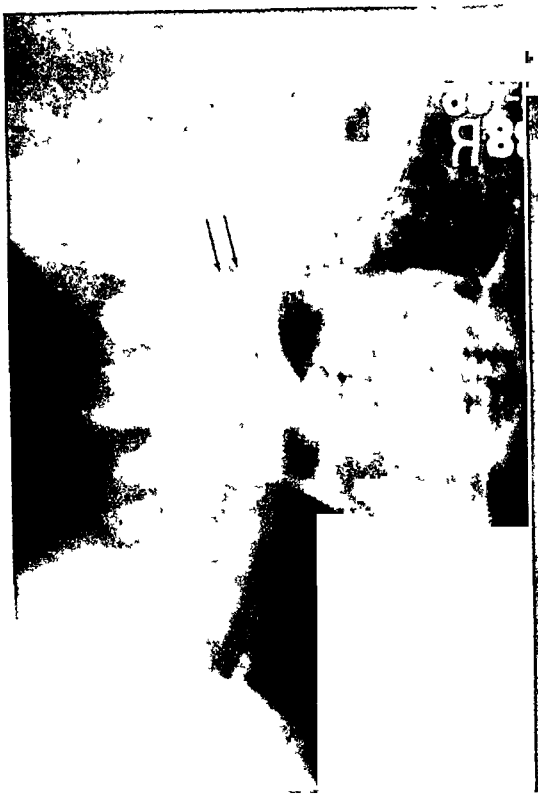


Fig. 1. Lateral view before reduction. There is anterior displacement of the atlas on the axis as determined by the line method of George and Leonard. There is some lateral tilting of the atlas. The arrows show the amount of odonto-atlantial displacement. Courtesy of Dr. Wendell Stewart.



Fig. 2. Semilateral view showing separation between the anterior arch of the atlas and the odontoid process. This separation could not be reproduced on the film in the case of another patient whose head was held flexed, tilted and rotated to the left within normal limits.

ETIOLOGIC FACTORS

The clinical and roentgenologic manifestations of unilateral rotatory displacement of the atlas are beyond the scope of this brief review. Excellent descriptions in the more recent communications, notably those of Coutts, Jackson, Langworthy, and Brookes adequately cover this phase of the subject. The etiologic factors heretofore reported may, however, be summarized.

Direct trauma to either side of the head is the commonest cause. Severe trauma is often associated with fracture, usually of the odontoid process. Brookes believes that alcoholism and the general toxic state associated with the prodromes of acute diseases are predisposing factors to dislocation by mild trauma. Blaine[13] and others have reported the occurrence of the condition following chiropractic manipulation. Over-correction of the deformity of torticollis has occasionally been the cause.

Indirect trauma, often of surprising mildness, has played a prominent part in the etiology of the cases reported by most writers. Thus, a sudden twist of the neck to respond to a greeting or to catch a ball has resulted in unilateral rotatory dislocation of the atlas. Yawning has been known

to produce it, and there are reports of its occurrence during sleep and during the convulsions of epilepsy or the tonic spasms of tetanus.



Fig. 3. Antero-posterior view showing elevation of the right lateral mass of the atlas and slight increase in the right atlanto-axial joint space.

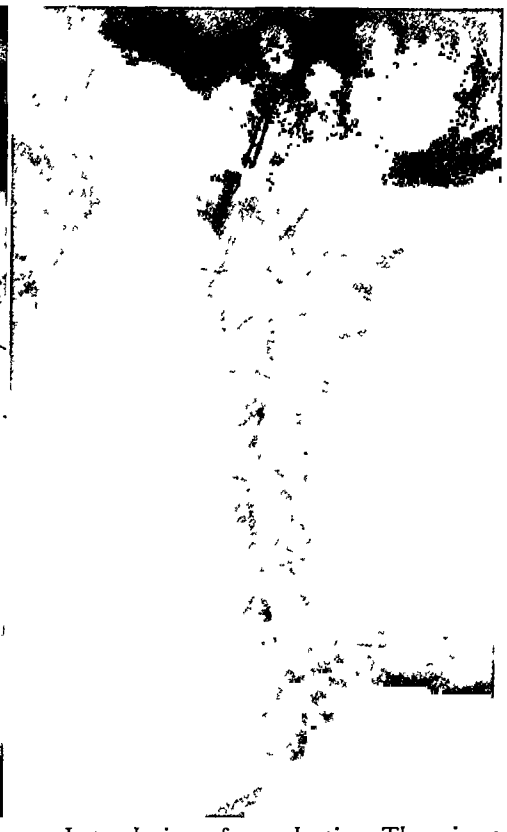


Fig. 4. Lateral view after reduction. There is no evidence of fracture or anomalous bone formation. There is normal alinement of the cervical spine. The odontoid process and the anterior arch of the atlas are in normal apposition.

Many of the earlier writers noted *spontaneous displacements* of the atlas due to bone disease, especially tuberculosis. Ely,[14] Rimbaud,[15] and Stammers and Frazer[16] have reported the condition as occurring during the course of chronic infectious arthritis. The latter observers believed it could be ascribed to distention of the bursa between the odontoid process and the transverse ligament with subsequent weakening of the latter structure. Muscular weakness as seen in infantile paralysis has been held responsible in some cases. Swanberg,[17] Barnett,[18] and Sudeck[19] have reported the condition following the relaxation of anesthesia. Congenital anomalies of the atlas or axis, luetic osteitis, osteomyelitis and metastatic malignancy have been noted as causes of spontaneous dislocation.

Dislocations of the atlas *during or following acute infectious diseases* have been noted by Mouriquand, Sédallian and Savoye,[20] by Jacobs[21] and by Berkheiser and Seidler.[22] The latter observers feel that in these cases there is a localization of the infection either in the capsules of the atlanto-axial joints or in the odontoid bursa, causing distention, relaxation and displacement. General weakness of the neck muscles during acute illness may be the basic factor.

Spontaneous *hyperemic dislocations* have been reported by Woltman and Meyerding,[23] Fitzwilliams,[24] A. R. Jones[25] and R. W. Jones.[26] The latter observer states that in 1833 Benjamin Bell described such a case following a deep ulcer in the back

of the neck which "destroyed the transverse ligament of the atlas." Jones believes that any infection which causes hyperemia at the base of the skull may predispose to displacement of the atlanto-axial joints. Such infections include tonsillitis, pharyngitis, otitis media, mastoiditis, cervical adenitis, and retropharyngeal abscess. Jones feels that direct association between the infection and the atlas is unnecessary and believes the displacement is due to a hyperemic decalcification of the atlas at the point of attachment of the transverse ligament with subsequent relaxation. Protective cervical muscle spasm is probably an important element in the production of this type of dislocation.

CASE REPORT

J. C., a white male, age twenty-nine, a photographer, was admitted to the Accident Ward of the Jewish Hospital at 3 P.M., December 25, 1934. The patient walked into the hospital with the assistance of a "younger brother." The latter stated that fifteen minutes previously the patient had fallen down the upper steps of a double-deck bus, striking the right side of his head. He was unconscious for about two minutes and was then brought to the hospital in a taxicab. When first seen the patient was supporting his chin with both hands. The neck was flexed on the chest and the head was tilted and rotated to the left. The patient complained of severe pain in the back of the neck, and slight pain in the right temporal region and the left shoulder. He complained of pain upon the slightest motion of the neck and refused to assume the recumbent position. Examination revealed tenderness over the upper cervical vertebra in the midline and to the right side. There was spasm of the muscles to the right of the midline in the cervical region and of the right sternocleidomastoid. The patient was perfectly rational, but extremely apprehensive, the face bearing an expression of genuine anxiety. The skin was cool and moist and there was mild but definite cyanosis. The blood pressure was 140 mms. systolic and 78 mms. diastolic. The temperature was 98.6°F., the pulse 92 and respiration 16. The patient coughed occasionally and expectorated a thin, slightly reddish sputum. There was no evidence of injury to the lips, mouth or pharynx. The patient belched frequently but there was apparently no difficulty

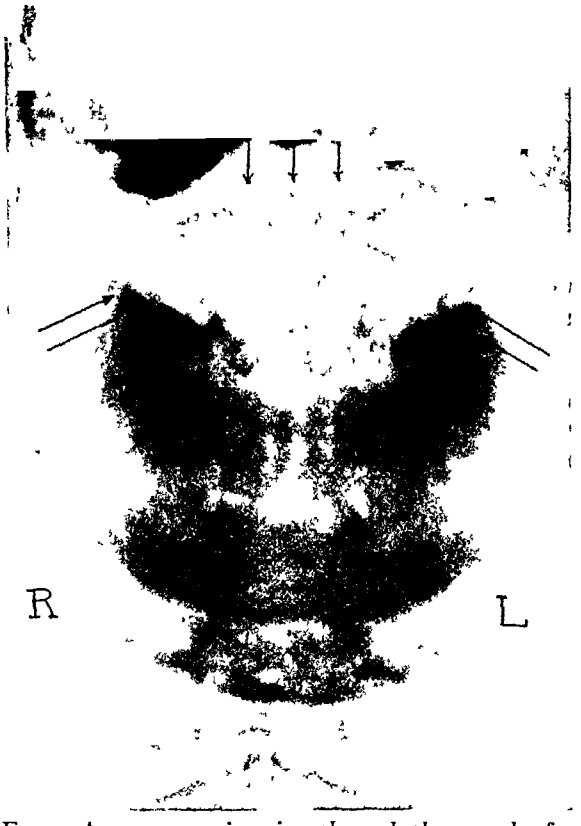


FIG. 5. Antero-posterior view through the mouth after reduction. The atlanto-axial relationship is normal.

in respiration. No sign of injury to the right side of the head was found and the examination of the left shoulder was entirely negative. There was no demonstrable muscular weakness or sensory change in the upper or lower extremities although the patient stated there was a feeling of numbness in the left arm and hand. Both patellar reflexes were moderately exaggerated.

Roentgenologic examination (Figs. 1, 2 and 3) revealed a rotatory subluxation of the right atlanto-axial joint. The anterior arch of the atlas was distinctly anterior to its normal position in relation to the body of the axis. The odontoid process was definitely posterior to its normal point of articulation with the anterior arch. A view through the open mouth was impossible to obtain because of the tilt of the head and inability of the patient to open his jaws. An antero-posterior film disclosed elevation of the right side of the atlas and widening of the atlanto-axial joint on the right.

Although the patient complained of severe pain, he refused all narcotics. An early attempt at reduction of the deformity was attempted by the resident, but was unsuccessful because of pain and muscle spasm. The patient was informed that reduction under an anesthetic was required. This was refused and only after considerable persuasion was written consent for the manipulation given. The deformity was easily reduced without anesthesia by the method of Walton, the head being further tilted to the left, then rotated under traction to the midline and hyperextended, counter traction being made on the shoulders. Following reduction, the patient still complained of pain, and the cyanosis persisted for several minutes. Roentgenograms taken at that time revealed a normal alignment of the atlas and axis (Figs. 4 and 5). The patient was placed in bed, ten pounds of weight were applied to the head by means of a leather harness and the head of the bed was elevated. The patient was informed that after several days' traction a plaster mould of the neck was to be made and a collar fitted.

The patient was difficult to manage. He complained of the head traction but refused sedatives. Twelve hours after the injury the temperature had gradually risen to 103°F. and the pulse to 112. The following day the temperature varied between 99.6°F. and 101°F. and the pulse between 98 and 108. The respiratory rate did not exceed normal limits. The Wassermann test was negative. The urine, blood count and blood chemistry were normal. The patient still complained of severe pain in the neck and of numbness of the left arm and hand. On one occasion he removed the head traction and sat upright in bed.

On the second day the temperature, pulse and respirations were entirely normal and there was no further increase at any time during his stay in the hospital. The patient was more comfortable, but again removed the head traction, despite warnings against the possibility of recurrence of the deformity. On the afternoon of the third day the patient became entirely unmanageable. He began to whimper and shake, complaining of numbness of the hands and a "floating feeling." That evening he stated he could stand the traction no longer, unfastened it, got out of bed and dressed himself. By creating a terrific disturbance at the hospital, the patient made a forced departure after signing a release.

Investigation revealed that the bus company had made a cash settlement with the patient a few hours prior to his hurried exit. A search of the hotel room which had been given as the patient's temporary address disclosed two empty suitcases. A nation-wide inquiry into the patient's identity was soon rewarded by a California police record, checked by actual photograph. This man had made numerous fraudulent claims throughout the country, simulating injuries while a passenger on public carriers. In no previous instance was there an alleged injury to the neck. Various Index Bureaus, having in their files the activities of similar swindlers, had no record of anyone with this particular amazing talent. The medical literature contained no parallel case. Other transportation companies had had no such experience. Meanwhile the patient had completely disappeared.

In March, 1935, a claim was made against a traction company for injuries sustained to the wrist by a man in Pittsburgh. The claimant attracted suspicion because of his anxiety for rapid settlement, but escaped before he could be arrested. Photographic check revealed him to be the person sought in Philadelphia.

In May, 1935 the patient appeared at St. Mary's Hospital, East St. Louis, Ill., having supposedly fallen down the steps of a bus in that city. He complained of severe pain in the neck and was somewhat cyanotic. The head was tilted and rotated to the left. The patient simulated paralysis of the left arm and leg and there was partial analgesia of these extremities. The left patellar reflex was exaggerated. Roentgenograms taken by Dr. Wendell Stewart revealed anterior rotatory subluxation of the right atlanto-axial joint. While the patient was being transfered to bed for reduction of the deformity by head traction, he gave a sudden cry, there was increased cyanosis and the head returned spontaneously or was returned voluntarily to normal position. Subsequent roentgenograms verified the reduction of the subluxation. After several days in bed, settlement was made by the bus company and this was followed by complete subsidence of symptoms and the patient's departure. The prompt recovery upon payment, however, and the widespread publicity of the Philadelphia investigation led to the patient's arrest as he was leaving the hospital. He pleaded guilty to

a charge of obtaining money under false pretenses and was sentenced to five weeks' imprisonment.

COMMENT

The medico-legal importance of this additional etiologic factor in unilateral rotatory subluxation of the atlas is self-evident. It is a well known fact that certain persons have the peculiar ability to partially or completely dislocate one or more of the larger joints, especially the hip and shoulder. Others, by muscular action, produce changes in surface contour simulating dislocation. Philadelphia anatomists know of no such voluntary control over the joints of the cervical spine. An extensive search of the literature has revealed no similar case. The basis for this voluntary control of the atlanto-axial joint must rest upon one of two possibilities. Anomalous development of the atlanto-axial region may have produced an unusual laxity of the capsule and surrounding ligaments; or previous actual traumatic, spontaneous, infectious or hyperemic dislocation may have occurred with residual laxity. It is hardly reasonable to believe that with normal atlanto-axial joints sufficient voluntary muscular control could be developed to produce displacement.

Roentgenograms show no abnormality of the bony structures, and the patient is loathe to discuss his previous history or the detailed mechanism of his prowess. It is hoped that this report will serve as a reminder of the astonishing ability of certain talented individuals to produce or simulate dislocations of various joint structures. Unilateral rotatory subluxation of the atlanto-axial articulation has been shown to come well within the range of their repertoire.

REFERENCES

1. Malgaigne, J. F. Traité des Fractures et des Luxations, Vol. 2, Paris, 1855, pp. 1108.
2. Walton, G. L. Dislocation of cervical vertebrae, *International Clinics*, Second Series, 2, 207–216, 1892.
3. Corner, E. M. Rotary Dislocation of the Atlas, *Ann. Surg.*, 45: 9–26, (Jan.) 1907.
4. Mixter, S. J. and Osgood, R. B. Traumatic lesions of the atlas and axis, *Ann. Surg.*, 51: 193–207 (Feb.) 1910.
5. Ogilvy, C. Subluxations of the atlas upon the axis, *Am. Journ. Orth. Surg.*, 12: 314–331, 1914–15.
6. Ranzi, E. and Vogl, W. Über Luxationen der Halswirbelsäule, *Arch. f. klin. Chir.*, 140, 234–249, 1926.
7. Jackson, R. H. Simple uncomplicated rotary dislocation of the atlas, *Surg. Gynec. Obst.*, 45, 156–164 (Aug.) 1927.
8. Langworthy, M. Dislocations of cervical vertebrae, *Jour. Am. Med. Assn.*, 94, 86–89 (Jan. 11) 1930.
9. Greeley, P. W. Bilateral rotatory dislocation of the atlas upon the axis, *Journ. Bone and Joint Surg.*, 12, 958–962 (Oct.) 1930.
10. Coutts, M. B. Atlanto-epistropheal subluxations, *Arch. Surg.*, 29, 297–311 (Aug.) 1934.
11. Brookes, T. P. Dislocations of the cervical spine, *Jour. Am. Med. Assn.*, 104, 902–906 (Mar. 16) 1935.
12. Hudson, O. C. Fractures and dislocations of the cervical spine, *Journ. Bone and Joint Surg.*, 17, 324–331 (April) 1935.
13. Blaine, E. S. Manipulative (chiropractic) dislocation of the atlas, *Jour. Am. Med. Assn.*, 85. 1356–1359 (Oct. 31) 1925.
14. Ely, L. W. Subluxation of the atlas. *Ann. Surg.*, 54, 20–29 (Jan.) 1911.
15. Rimbaud, M. L. Luxation de l'atlas en apparence spontanée. *Marseille méd.*, 53: 493–494, 1916–17.
16. Stammers, F. A. R. and Frazer, P. Spontaneous dislocation of the atlas. *Lancet*, 2: 1203–1205 (Nov. 25) 1933.
17. Swanberg, H. Anterior dislocation of the atlas following tonsillectomy. *Jour. Am. Med. Assn.*, 72: 107–108 (Jan. 11) 1919.
18. Barnett, J. B. Cervical subluxation following anesthesia. *Brit. Med. Journ.*, 1: 1077 (June 15) 1929.
19. Sudeck, P. Über die Drehungsverrenkung des Atlas. *Deutsch. Zeitsch. f. Chir.*, 183: 289–303, 1924.
20. Mouriquand, G. Sédallian and Savoye, J. Luxation de la colonne cervicale au cours de la fièvre typhoïde. *Lyon méd.*, 147: 86–88 (Jan. 18) 1931.
21. Jacobs, C. M. Atlas and axis luxation. *Am. Journ. Orth. Surg.*, 16: 357–364 (Oct.) 1918.
22. Berkheiser, E. J. and Seidler, F. Non-traumatic dislocation of the atlanto-axial joint. *Jour. Am. Med. Assn.*, 96: 517–523 (Feb. 14) 1931.
23. Woltman, H. W. and Meyerding, H. W. Spontaneous hyperemic dislocation of the atlo-axoid. *Surg. Clin. N. Amer.*, 14: 581–588 (June) 1934.
24. Fitzwilliams, D. C. L. Inflammatory dislocation of the atlas. *Brit. Med. Journ.*, 2: 107–109 (July 21) 1934.
25. Jones, A. R. Dislocation of neck at atlanto-axial joint. *Proc. Royal Soc. Med.*, 26: 136–137 (Dec.) 1932.
26. Jones, R. W. Spontaneous hyperemic dislocation of the atlas. *Proc. Royal Soc. Med.*, 25: 586–590 (Feb.) 1932.

ABERRANT LINGUAL THYROID

REPORT OF A CASE*

HERMAN RUBIN, M.D.

BROOKLYN, N. Y.

B. S., male, age thirty years, was admitted to the hospital on January 16th, 1933, with a five year history of a gradually increasing lump on the back of his tongue which interfered with deglutition. Only liquids and semi-solids could be swallowed, and this was occasionally followed by choking and coughing. His speech was impaired, his voice being thick and non-resonant. During this period he had gained about thirty pounds in weight.

Examination revealed a male adult presenting all the signs of myxedema, such as sluggish mentality, swollen face, thickened lips and eyelids, edema of the hands and feet, loss of hair, dryness and roughness of the skin. No evidence of a thyroid gland could be found upon examination of the lower part of the neck. The trachea could be readily palpated. The tongue presented a large, firm, solid dull red mass, posteriorly in the midline, extending to the entire undersurface of the tongue above the hyoid bone.

Mirror examination showed this mass extended downward and backward toward the pharyngeal wall obscuring the view of the epiglottis and the remainder of the larynx. Direct laryngoscopy demonstrated that the tumor mass was central and attached to the posterior surface of the tongue, with many large veins seen traversing it. It was impossible to elevate the tongue with the tip of the laryngoscope, so that a view of the larynx was unobtainable. A small piece of tissue was removed for biopsy. This was followed by a severe hemorrhage which was finally controlled by the electric cautery.

Lateral *x*-ray picture of the neck revealed a large mass extending downward from the tongue into the pharynx, depressing the epiglottis and narrowing the lumen of the oropharynx. The tumefaction reached into the sublingual region and appeared to be pushing the hyoid bone downward.

The basal metabolic rate on admission was minus 26. Under thyroid therapy this rose and became normal, and the symptoms of myxedema disappeared within two weeks. The patient became more alert mentally, the edema of the face and legs was no longer present while the skin became smooth and moist.

The *x*-ray study (Fig. 1) would indicate that the patient had both a lingual and a sublingual thyroid tumor. Although this mass was causing difficulty in swallowing, it was felt that surgery should not be done, because of the myxedma. Even if this were not so, the severe hemorrhage that followed attempted removal of the lingual thyroid tissue, might be repeated and endangered the patient's life. In addition, no thyroid tissue could be detected in the neck. Unfortunately, the biopsy specimen was lost. However, it was felt that we were dealing with some form of degeneration of the thyroid tissue, which originally made up the mass.

Of the aberrant tumors of the thyroid, those in the lingual region are probably the rarest. In 7600 cases of thyroid disease at the Lahey Clinic only 2 were encountered and only 2 in 4000 cases at the University of Pennsylvania. Lingual thyroids can cause asphyxia in the newborn, troublesome hemorrhage, myxedema and on rare occasion may be the seat of carcinoma. Approximately 150 cases have been reported in the literature. This condition occurs about eight times as often in males as in females. The average age is thirty years.

What was probably the first case of lingual thyroid was described by Hickman[9] in 1869. His patient was a newborn infant who appeared to be asphyxiated, and palpation revealed a mass filling the oral cavity. Death occurred before a life-saving tracheotomy could be done. Postmortem examination revealed a lingual goitre com-

* From the Otolaryngological Service of Dr. Louis C. Menger, Bushwick Hospital.

pletely filling the pharynx. Meixner[15] reported a case in which the child never breathed, postmortem examination revealed a large growth pressing upon the epiglottis. Perkins,[21] quoting Aschoff, reported the case of a six months old infant, who died of myxedema, in which a lingual thyroid was found at postmortem.

New's[18] patient was probably the youngest in the literature. A male infant of three and one-half months had had difficulty in breathing and swallowing since he was two weeks old, because of a mass on the dorsum of the tongue. New has seen 10 cases, probably the largest number observed by any individual. In none of his cases was the mass large enough to cause alarming symptoms so no treatment was required.

Bernays[2] in 1888, described the first operated case of lingual thyroid. The patient, a girl of seventeen years, had both a sublingual and a lingual thyroid. Both tumors were removed by means of an incision extending from the inferior maxilla to the hyoid bone, which divided all the structures down to the tumor.

Spontaneous hemorrhage from the large vessels coursing across the tumor is nto uncommon. According to Grace and Weeks[6] this occurred in 8 of the 81 cases which Dore collected. Hemorrhage is frequently encountered when tissue removal for biopsy is done. This occurred in the writer's case.

Rabinowitz[23] reported a case in a female, age forty-seven years, who for four months had a mass on the posterior surface of the tongue which occupied almost the entire thickness of the tongue and extended well into the suprahyoid region. Following a section for biopsy severe bleeding occurred which required several mattress sutures for its control. The tumor was not removed because of the hemorrhage and the presence of myxedema. There were no symptoms of pharyngeal or laryngeal obstruction and no thyroid tissue was to be found in the neck.

Pearlman[20] and Porter[22] described hemorrhage as a symptom. Monroe and Taylor's[17] patient had symptoms of myxedema in which the tumor was removed because of attacks of bleeding and difficulty in swallowing. Smythe[24] reported an interesting case in a female of seventy-nine years, who choked while eating canned corn. Her son attempted to remove the foreign body with his finger and caused a severe hemorrhage. Kramer's[11] patient suffered with occasional profuse, hemorrhages from the mouth over a period of ten years. Her basal metabolic rate before operation was normal. Ten days after removal of the tumor she showed signs of myxedema.

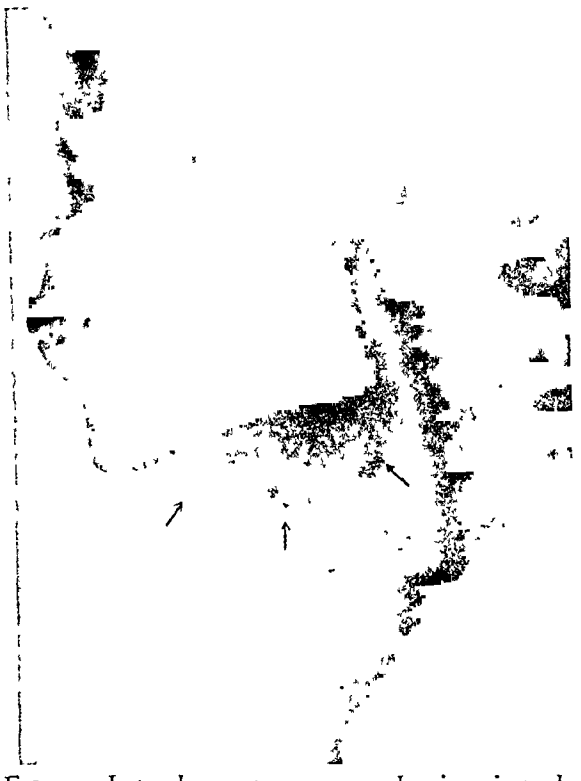


Fig. 1. Lateral roentgenogram showing irregular tumor mass at the tongue base and large rounded tumor mass filling sublingual region.

Two cases of a lingual thyroid attached by a pedicle have been described. Bishop[3] reported a case in which the lingual thyroid was connected to the base of the tongue by a pedicle and was removed under local anesthesia with a tonsil snare. Harvey[7] had a similar experience with a female of twenty-six years, who was a cretin and looked like a child of eight years. She had no palpable thyroid tissue in the neck. The

growth was removed because of severe hemorrhages, dyspnoea and dysphagia.

Myxedema is frequently encountered in lingual thyroids. A basal metabolism should always be done in this condition before contemplating any operative procedure. The percentage of cases of myxedema occurring after operations on the lingual thyroid, has been estimated by various authors to range from 15 to more than 50 per cent. In the absence of other demonstrable thyroid tissue, complete removal of the lingual thyroid is definitely contraindicated. The frequency of myxedema is relatively great following its removal. The experiences of Lahey,[12] Miller,[16] Ziegelman,[26] Bisi,[4] Cattell and Hoover,[5] Harvey,[7] Haynes,[8] Lenzi,[13] and Kramer[11] prove this to be so.

Cattell and Hoover[5] report the case of a woman of sixty-two years, who had a growth on the tongue for forty years. She developed small masses in the skin of her back and which later became scattered over her body. The thyroid gland could not be palpated. At postmortem it was thought that death resulted from melanosarcoma with widespread metastases. Microscopic examination however showed that these growths were leukemic nodules. Similar deposits were found in the trachea, lymph nodes and other organs.

Lahey[12] reported a female of twenty-five years, who had had a tumor at the base of the tongue since birth. Her basal metabolism before operation was normal. Twelve days after operation it was minus 18. After two months thyroid extract medication it became plus 19. Lenzi[13] reported a case in which myxedema developed following the removal of a tumor in the submaxillary region and another at the base of the tongue. Examination showed both tumors to contain thyroid tissue. Hill[10] reported a case in a Negress, nine years old, who had a lump on the tongue for three years. No thyroid could be felt in the neck. Goiters were present in both the mother and grandmother.

Whalen[25] reported a case in a female of twenty-four years, in which the size of the lingual thyroid was reduced by puncture with the endothermy electrode without developing symptoms of myxedema. Ziegelman[26] states that St. Clair Thomson was the first to suggest the use of electrocoagulation in the treatment of lingual goitre.

Owens[19] describes the case of a female of thirty-six years who did not develop myxedema nine months after removal of a lingual tumor. Although he could not find any thyroid in the neck, he felt that she probably had thyroid tissue elsewhere.

Carcinoma occurring in a lingual thyroid is a rarity, only 2 cases having been reported in the literature. Ashhurst and White[1] report the case of a male, fifty-six years of age, who had a lump on the back of his tongue for more than twenty years. Five years after this was first noticed, he began to complain of pain. The mass was considered as lingual tonsil tissue and therefore removed. Bilaterally enlarged glands of the neck appeared, three years after operation. The tongue growth gradually returned. The mass was hard and slightly ulcerated, and was removed with the electric cautery knife, under intratracheal ether anesthesia. This proved to be adenocarcinoma of a lingual thyroid.

Levi and Hankins[14] reported the second case in a female of twenty-one years, who had a mass on the posterior portion of the tongue. Swallowing produced pain, choking and coughing. A small mass in the region of the posterior surface of the tongue, was removed by actual cautery under ether anesthesia. Biopsy revealed a low grade carcinoma arising in the thyroid tissue. She developed an edema of the larynx on the second day following operation which necessitated a tracheotomy. The tube was removed two weeks later.

CONCLUSIONS

One must always bear in mind the possibility of the presence of an aberrant thyroid tumor on the posterior dorsum of the tongue. The diagnosis is established

when no thyroid tissue is detectable in the neck and unusual vascularity is noted. The usual picture presented is that of a smooth, rounded mass in the preepiglottic region with relatively large blood vessels traversing its surface. Sectioning for biopsy may mean severe, and at times, seriously troublesome hemorrhage. Also the thyroid tissue at the tongue base may be all that the patient possesses, so that its removal will cause myxedema and necessitate taking thyroid extract for the remainder of one's life.

Carcinoma of the lingual thyroid is unusually rare.

SUMMARY

A case is reported in which a patient had an extensive tumor in both the lingual and sublingual regions, with myxedema as the predominant picture. The condition cleared after the administration of thyroid extract. The importance of knowing the patient's metabolic rate is stressed. The hemorrhage incidental to biopsy was so severe as to require electrocautery for its control.

The value of *x*-ray films in the lateral plane of the tongue base region, is demonstrated.

REFERENCES

1. Ashhurst, A. P. C. and White, C. Y. Carcinoma in aberrant thyroid at base of tongue. *Jour. Am. Med. Assn.*, 85: 1219–1220 (Oct. 17) 1925.
2. Bernays, A. C. Operation of a rare tumor of the root of the tongue. *St. Louis Med. and Surg. Jour.*, 55: 201 (Oct.) 1888.
3. Bishop, F. J. Lingual thyroid. *Ann. Otol. Rhin. Lary.*, 43: 294–298, (March) 1934.
4. Bisi, H. Aberrant thyroid at base of tongue., *Revue Ass. Med. Argentine*, 46: 1467–1468 (Nov.) 1932.
5. Cattell, R. B. and Hoover, W. B. Lingual thyroid, report of case. *Surg. Clin. N. Amer.*, 9: 1355–1362 (Dec.) 1929.
6. Grace, R. V. and Weeks, C. Lingual goitre, *Ann. Surg.*, 96: 973–978, (Dec.) 1932.
7. Harvey, F. Pedunculated thyroid tumor at base of tongue. *Brit. Jour. Surg.*, 13: 746–748 (April) 1926.
8. Haynes, I. S. Sublingual thyroid. *Ann. Surg.*, 56: 465–467, 1912.
9. Hickman, W. Congenital tumor of the base of the tongue, causing death by suffocation. *Trans. Path. Soc.*, London, 20: 160, 1869.
10. Hill, R. C. Lingual thyroid. *Jour. Med. Ass. Alabama*, 3: 103–104, Sept., 1933.
11. Kramer, R. Lingual Thyroid. *Laryngoscope*, 39: 546 (Aug.) 1929.
12. Lahey, F. H. Lingual Goitre. *Surg. Gynec. Obst.*, 36: 395, 1923.
13. Lenzi. I. Due strume a sede rara; contributo allo studio del grozzo luiguale. *Sperimentale, Arch. di. biol.*, 59: 852, 890, 1905.
14. Levi, L. M. and Hankins, F. D. Carcinoma of the lingual thyroid. *Amer. Jour. Cancer*, 23: 328–333. (Feb.) 1935.
15. Meixner, K. Zwei Falle von struma baseos linguae. *Deutsch. Ztschr. f. Chir.*, 88: 1–19, 1905.
16. Miller, R. H. Lingual goitre. *New England Med. Jour.*, 208: 480–484, (Mar. 2) 1933.
17. Monro, T. K. and Taylor, M. L. Lingual goitre, removal followed by myxedema. *Glasgow Med. Jour.*, 105: 213–215 (Mar.) 1926.
18. New, G. B. Congital obstruction of larynx and pharynx. *Jour. Am. Med. Assn.*, 81: 363 (Aug. 4) 1923.
19. Owens, M. J. Lingual thyroid. *Jour. Kansas Med. Soc.*, 26: 160, 1926.
20. Pearlman, H. B. Lingual thyroid. *Arch. Otolaryng.*, 19: 594–599 (May) 1934.
21. Perkins, C. E. Accessory thyroid at base of tongue. *Laryng.* 18: 292–296, 1908.
22. Porter, L. B. Lingual thyroid. *Rhode Is. Med. Jour.*, 17: 103–104 (June) 1934.
23. Rabinowitz, M. A. Aberrant thyroid tumor of the tongue. *Surg., Gynec. Obst.*, 27: 191–194, 1918.
24. Smythe, H. E. Accessory thyroid tumors of the tongue. *Ann. Otol., Rhin., Laryng.*, 20: 367, 1911.
25. Whalen, E. J. Lingual goitre. *Laryngoscope.* 44: 555–567 (July) 1934.
26. Ziegelman, E. F. Lingual goitre. *Arch. Otolaryng.*, 16: 496–505, Oct., 1932.

INTRASCROTAL LIPOMA

FEDOR L. SENGER, M.D., F.A.C.S. AND JOHN J. BOTTONE, M.D.

BROOKLYN, N. Y.

IT is difficult to determine the frequence of a solid mass of fat within the scrotum, but the number reported is small, though interesting because of the diagnostic difficulties associated with them. Textbooks on urology merely mention them under the general heading of scrotal tumors.

The majority of fatty tumors recorded in the literature, evidently originated from the structures in close relation to the scrotal walls rather than from the tissues which comprise the walls. For instance, either arising from the fat in the spermatic cord or from the preperitoneal fat which descended through the inguinal canal into the scrotum. In some cases, like one reported by Cecil, it is almost impossible to surely determine whether the new growth arose from the subcutaneous scrotal tissues or from the elements of the spermatic cord due to the distortion resulting from the size of the growth and pressure effects. Curling believed that these tumors developed from the fat of the spermatic cord. Lipomatous tumors lying extravaginally and probably arising from isolated fat cells in the subcutaneous tissues of the scrotal wall are extremely rare. This is due to the fact that fat cells in this areolar tissue are exceptionally few in number and may be entirely absent.

Intrascrotal tumors have occurred most frequently in men between the ages of forty and sixty, rarely in the adolescent and never in infancy. They vary in size, weighing as much as twenty pounds and descending to the knee, as in one case reported by Kocker, and are encountered most frequently in the left side. Occasionally, a history of trauma is obtained. Recurrence after surgical removal is common and sometimes is found to be malignant. Curling operated upon a patient four times over a period of many years for recurrences, evidently dealing with a mixed tumor. C. Bonney reported a case of bilateral scrotal lipomata, surgically removed after twenty-one years duration, and nineteen years later there was a sarcomatous recurrence on the left side.

In spite of the large size of these tumors the testicle and epididymis, as a rule are not affected. These tumors cause very little disturbance, the patient simply experiencing the discomforts that result from its size and weight.

Diagnosis must be differentiated from an irreducible omental hernia, a cystic tumor of the testicle or an hematocele. It is particularly difficult to make the diagnosis when the lipoma can be pushed back through the inguinal ring as if one were apparently reducing a hernia. In cases of a fatty tumor in the scrotum, Cecil advises one to bear in mind that a small hernial sac may be found within it, i.e., there is a hernia surrounded by fat. Therefore, in removing a lipoma of the scrotum, it is essential to investigate the inguinal ring for the presence of a herniation. Although the characteristic cystic feel and lobulations of a lipoma make one suspect its presence anywhere in the body, in the scrotum the diagnosis is difficult and is rarely made without an exploratory incision. The treatment consists of a thorough and complete excision of the growth to prevent recurrence.

Macroscopically and microscopically intrascrotal fatty tumors simulate lipomata found in the human body. The adipose tissue of which they are composed is arranged in lobules and differs little from normal fat except that the cells and lobules are usually larger and less regularly arranged and is paler than normal fat, so that if such a tumor is situated in adipose

tissue its limits can be readily outlined. They are usually encapsulated, making excision easy.

The following case came under our observation at the Kings County Hospital. The preoperative diagnosis was probable fibrolipoma of the scrotum, originating from the subcutaneous tissues of the scrotal wall.

Mr. J. Y., aged fifty-nine years, was admitted to the hospital on August 29, 1935, complaining of swelling in the region of the left testicle of two years duration, which has gradually increased in size. Although a laborer, the patient could not recall receiving any injury to this region. There was never any evidence of inflammation or pain. His family history is irrelevant. With the exception of a case of uncomplicated gonorrhea at the age of eighteen years, the patient's health has been remarkably well. There have been no operations or injuries and he denies a penile sore by name and description. He is married, has three children and his wife is living and well.

Physical examination showed an extremely well nourished adult male not appearing ill. The pupils were equal and reacted to light and accommodation. The teeth were in poor condition. The lungs were normal on percussion and auscultation, as was the heart. The abdomen was negative, no masses were palpable. The blood pressure and pulse were within normal limits. In examining the external genitala, the penis was normal, no discharge. Both the right and left testicles and epididymi were normal. No inguinal hernias were found. In the left side of the scrotum was palpated a soft, nodular, nontender, almost cystic mass about the size of a small orange. There was no fluid and light was not transilluminated. The tumor was not attached to the testicle, epididymis or spermatic cord but was adherent to the lateral and posterior walls of the scrotum. Rectal examination was negative. Urine analysis and Wassermann were negative.

Operation. Under gas-oxygen anesthesia, an anterior incision was made through the scrotal skin and dartos exposing the mass, which was definitely encapsulated and removal was accomplished without difficulty. The tunica vaginalis was not opened. As far as we were able to determine, the growth was not attached to the cord. Recovery was rapid and complete.

Pathological Report. The mass is about 3 by 3 inches in size and is composed wholly of adipose tissue. The tumor surface is irregularly

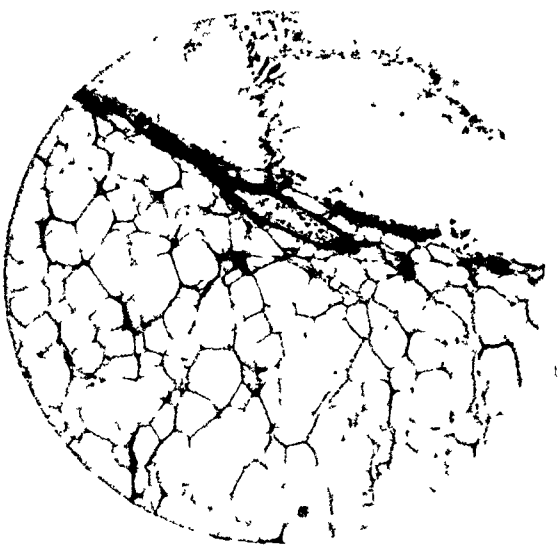


Fig. 1. Section of tumor removed showing the typical fatty structure. (Magnification 120 ×.)

nodular. The cut surface is lobulated and in appearance like normal fat. Microscopic sections made from several parts of the tumor show the usual characteristics of a lipoma. There is no evidence of malignant degeneration.

Diagnosis. Lipoma.

CONCLUSIONS

The case reported is one of a pure lipoma of the scrotum occurring in a male of fifty-nine years. The tumor was situated extravaginally, attached to the scrotal wall and had no connection to the spermatic cord. Its probable origin was from fat cells in the loose areolar tissue beneath the dartos. Complete recovery followed simple excision.

REFERENCES

1. Minami, H. and Tosawa, G. Unusually large lipoma of the scrotum. *Acta Dermat* 21: 72, 1933.
2. Livermore, G. C. Lipo-myxo-sarcoma of the scrotum. *Brit. J. of Urol.* 5: 49 (March) 1933.
3. Bonney, C. W. Lipoma of the scrotum. *Urol. and Cutan. Review* 34: 299–301 (May) 1930.
4. Roeder, C. A. Lipoma of the testicle. *Annals of Surg.* 85: 275, Feb. 1927.
5. Cecil, A. B. Intrascrotal Lipomata. *Jour. of Urol.* 17: 557–565 (June) 1927.
6. Hay, J. M. Fatty tumors of the inguinal canal and scrotum. *Southern Med. Jour.* 221: 1005–1007 (Dec.) 1928.
7. Delafield and Prudden. Textbook of Pathology, Thirteenth Edition, 1925.

PLACENTA ACCRETA

REPORT OF A CASE*

MICHELE TOMAIUOLI, M.D.

WEEHAWKEN, N. J.

THE literature of placenta accreta consists chiefly of personal case reports. It was Polak's masterful contribution in 1925 that aroused interest in this unusual condition, and Arthur C. Tiemeyer further enriched the literature with his noteworthy article in 1930. However, in 1933 Phaneuf made a thorough and exhaustive search of the literature collecting 82 cases; tabulated his findings and reported 2 additional cases. Since his publication a case has been reported respectively by E. Capecchi, S. Freitas, G. Giavotto, H. O. Newman, R. K. Smith, Solomon and Bourke, making a total of 90. With my case, herein discussed, the number of authentic cases reaches a total of 91.

That this should represent the true number of cases which have actually occurred, no one, I believe, seriously contemplates. On the other hand, that it is a rarity cannot be denied. Its occurrence ranges between the estimated 1 in 6000 by Polak to 1 in 40,000 by Hirst, with an average of 1 case in 14,622 deliveries according to Phaneuf.

A distinction must be made between a retained placenta, an adherent placenta and a placenta accreta. The former is a detached placenta retained in the uterine cavity by a premature closure of the retraction ring; the second is a placenta which fails to detach itself usually because it is thinned out over a large area but can be easily removed manually and in toto because a line of clevage does exist and is easily found by the gloved fingers; the third, or placenta accreta, is one where an intimate union exists between the placenta and the uterine muscle. The term itself is derived from the Latin: ad-crescere meaning "to grow to." Hence a spontaneous detachment can never occur and a manual removal is not only impossible but laden with deadly danger. Phaneuf states that in a series of 36 cases treated by manual extraction 26 died and 10 recovered. "The women who recovered" he believes, "probably had partial placenta accreta . . . for it seems almost unbelievable that one could separate an entire placenta from the uterine musculature without tearing the uterus and without severe hemorrhage and sepsis, the complications to be feared and which usually result in death when this method is persisted."

The mechanism by which a placenta accreta forms is supposed to be simple. It is believed that it results from the absence, total or partial, or abnormal alteration of the decidua basalis which leaves the unprotected uterine muscle wall a prey to the penetrating and erosive action of the trophoblasts and chorionic villi. An idea of this erosive and penetrating activity can be gained by the case reported by C. E. Tennant, where the autopsy demonstrated that the placental attachment not only penetrated the peritoneal coat of the uterus in the fifth month of gestation, but that it actually invaded the visceral cavity.

The causes of the absence of the decidua basalis are protean and, according to the authorities, may be summarized as previous manual removal with febrile reaction, as in the case herein presented, repeated curettages, submucous fibroid (as was one of the cases reported by Polak), endometritis, and abnormal position of the placenta as in placenta previa.

I confess that I cannot be in complete accord with this. It seems to me that if

* From the Surgical Service of Christ Hospital, Jersey City, N. J.

these etiological factors were true, placenta accreta would be encountered more frequently. It is true that these causes damage the endometrium and that a normal endometrium is necessary for the proper development of the decidua, still, as Tiemeyer very properly says, "Other factors, however, enter into the formation of the decidua. . . . It is believed that the hormones from the corpus luteum control the formation of the decidua, and abnormalities of the corpus luteum may have some bearing on the formation of this condition by producing a defective decidua basalis."

The following report is published not only because of the rarity of placenta accreta, but also to stress the dramatic results which may attend the management of such a case.

CASE REPORT

Mrs. A. C., a secundigravida 36 years old, was seen on September 30, 1934. Her history is devoid of interesting data except that following the normal birth of her previous and first child on May 1, 1931, the placenta failed to be expelled and was retained for three hours, when a physician called by the midwife in attendance, proceeded to manually deliver the placenta in toto. The following day, however, the temperature rose to 102°F., and persisted with slight variations for eleven successive days.

Early in the afternoon of September the 30, 1934, the midwife in attendance called me to see this patient. I noticed a prolapse of the cord and an abundance of meconium. Examination revealed a podalic presentation and in order to obtain a living child I proceeded to deliver the fetus. Some difficulty was encountered in the deliverance of the head especially since the parturient was extremely uncooperative. A 7½ pounds male child was finally delivered but was asphyxiated. The several procedures for resuscitation were employed and ten minutes afterwards the first cries of life were noted. While occupied resuscitating the child I was noticing, nevertheless, that the patient was having a profuse hemorrhage. My efforts, therefore, were turned to the mother. After several attempts at expelling the placenta, Crede's method was tried, but without success, the hemorrhage continuing with alarming signs. Since the safety of the patient seemed at stake, resort was made to manual removal,

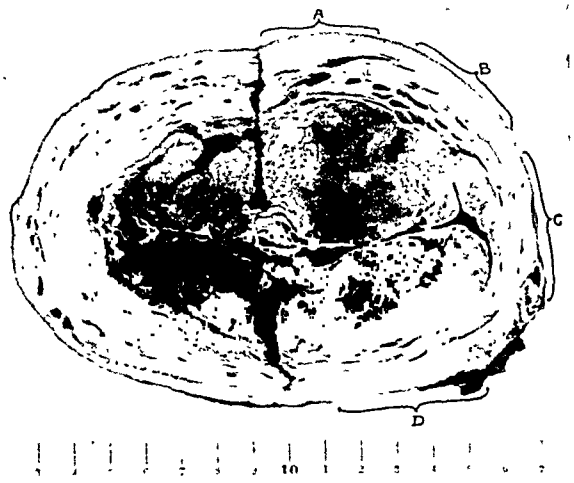


Fig. 1. Photograph of specimen through a plane at right angles to the long axis of the uterus. Sections were cut along the circumference from A to D.

but the gloved fingers sought vainly for the familiar line of cleavage. The patient by now seemed to be rapidly sinking. She was cold and clammy perspiration covered her face and limbs: her pupils were dilated and vision dimmed; the pulse was imperceptible and the heart sounds rapid and feeble. A sterile pack was therefore quickly inserted, the foot of the bed elevated, heat applied and hypodermic injections of camphor in oil, adrenalin and caffein sodium benzoate were given in rapid succession. As her condition was critical she was hospitalized immediately.

Heroic therapeutic measures were instituted; the foot of the bed elevated, intravenous clysis of saline and glucose; black coffee and whiskey per rectum; hot water bottles and warm blankets—and cardiac stimulents. After an hour or so she improved somewhat temporarily. That evening her condition again became precarious and she was transfused receiving 500 c.c. whole blood. The improvement in her condition was striking.

Twenty hours after her admission the packing was removed; the bleeding had stopped. In an effort to extract the placenta without much interference, 250 c.c. of sterile saline was injected into the cord vein, the latter clamped and an ampoule of obstetrical pituitrin administered. The result was negative and a placenta accreta was accepted as the likeliest diagnosis.

Gynecological consultation confirmed the necessity of supravaginal hysterectomy. Her condition, however, justified postponement for another day in order that she could be better prepared for the operation.

That night she developed a chill and her temperature spiked to 103°F. Another chill and elevation of temperature occurred the next morning, but even though this was attributed to sapremia, it was evident that no time was to be lost for the operation.

Actuated only by the desire to avoid the operation, while the patient was under gas, oxygen and ether anesthesia, a last attempt was undertaken to extract the placenta manually. While introducing my fingers in the uterine cavity and as gently as possible seeking the edge of the placenta, the uterine wall at the level of the internal os posteriorly, suddenly gave way, as if offering only a tissue paper like resistance, and the peritoneal cavity was entered. A speedy supravaginal hysterectomy with drainage was done immediately, while an intravenous infusion of saline and glucose was being administered concomitantly. The tear was verified by sight and the presence of fresh blood.

Inasmuch as the prognosis was questionable, an indirect transfusion of 500 c.c. citrated blood was given her while in bed. After three days of stormy convalescence she began to respond favorably. She was discharged from the hospital fully recovered, 27 days after admission.

Pathological Report by Frederick A. Hemsath, M.D.



Fig. 2. Low power microphotographs of celloidin sections from the areas A to D in Fig. 1. Note the greatly dilated venous channels. The blocked area 1, magnified in Fig. 4, shows the thickest portion of decidua found in these sections.

Specimen consists of a supracervical portion of uterus measuring 14 cm. in height, 15 cm. in width and 12 cm. in thickness. Section after preliminary fixation shows the uterine wall 3 cm. in thickness along the lower uterine segment and 1.4 cm. at the fundus. A placenta is firmly adherent to the midportion of the cavity and the myometrium beneath the placenta shows greatly dilated venous channels. The uterus shows no evidence of rupture nor hemorrhage into any portion of the lower uterine segment.

Microscopic Examination. Sections from one-half circumference of the uterus along the placental implantation (Fig. 1, A, B, C, D.) are cut 16 millimicrons in thickness after celloidin imbedding and stained by hematoxylin and Orange G. Examination shows a deficient decidua vera with absence of decidua spongiosum. The chorionic villi are separated from the myometrium by a fibrinous layer (Nitabusch) of varying thickness beneath which, in many places, there is a layer of dense decidua. In other areas the fibrinous layer is directly in contact with myometrium. The only endometrial gland seen is present in a portion of decidua capsularis. Groups of chorionic wander-

ing cells are found at short distances within the myometrium but actual penetration of villi into the myometrium is not noted.



Fig. 3. A higher magnification of blocked area 2 of Fig. 2 showing fibrinous layer in direct contact with myometrium.

Polynuclear infiltration of the placenta, decidua and myometrium is extensive in some areas.

Diagnosis: Placenta accreta, acute placentitis and myometritis.

At this time some pertinent remarks on the history as given become evidently necessary.

It is known that placenta accreta does not cause any postpartum hemorrhage. How then can the serious hemorrhage sustained by this patient be explained? I believe the answer is simple. The patient was "uncooperative" during the somewhat difficult extraction of the head, and realizing that no undue effort was exercised in introducing the hand in my last effort to extract the placenta, it becomes evident that the bleeding came from a tear in the cervix caused while delivering the head, and it was this tear that made the subsequent perforation so effortless. The bleeding could also have occurred from a partial separation of the placenta but Doctor F. A. Hemsath in examining the specimen told me that "the placenta and its membranes were firmly adherent to the myometrium and at no point could separation be found."

SUMMARY AND CONCLUSIONS

1. The literature of placenta accreta is reviewed. To date there are 90 cases reported. My case brings the total to 91.



Fig. 4. Higher magnification of blocked area 1 of Fig. 2 showing, from above downward, chorionic villi, fibrinous layer, decidua compacta and myometrium.

2. Placenta accreta is not well known. The lack of knowledge of this condition plus the lack of hospital facilities in many regions must of necessity keep many other cases from the literature.

3. The role of the corpus luteum in the etiology of placenta accreta should be more thoroughly investigated.

4. Postpartum hemorrhage does not occur in placenta accreta. When it does occur it is due either to cervical tear or to partial placenta accreta.

5. If after delivery of the fetus the placenta is not expelled the known maneuvers to promote this should be tried. As a last resort, under asepsis, the gloved fingers should be inserted into the uterine cavity in an attempt to expel the placenta

manually. If no line of cleavage can be found the project should be abandoned for a placenta accreta then exists. Removal to a hospital and supravaginal hysterectomy usually give favorable prognosis.

6. Any persistent attempt to manually remove a placenta accreta is foolhardy. Fatal hemorrhage, sepsis and perforation are the usual outcome.

7. A case of placenta accreta is reported in detail.

The writer wishes to express his gratitude and appreciation to Dr. W. L. Yeaton, Jr., for his assistance and helpful suggestions.

REFERENCES

1. Andrews, C. J. Report of a case of retained placenta, clinically placenta accreta. *Jour. Am. Med. Assn.*, 82: 1780, 1924.
2. Phaneuf, Louis, E. Placenta accreta; a review of the literature and the report of two personal cases. *Surg., Gynec. Obst.*, 57: 343, 1933.
3. Polak, J. O. and Phelan, G. W. Placenta accreta; its incidence, pathology and management. *Surg., Gynec. Obst.*, 181, (Feb.) 1924.
4. Tennant, C. E., Wilson, R. E. and Craig-Sullivan H. Placenta accreta; report of a case. *Colorado Med.*, (April) 1925.
5. Tiemeyer, A. C. A case of placenta accreta. *Am. J. Obst., Gynec.*, 22: 106, 1931.
6. Wilson, R. A. Report of a case of placenta accreta; with a discussion of its treatment and the unusual sequelae. *Am. J. Obst. Gynec.*, 17:58, 1929.
7. Newman, H. O. Abnormally deep growth of chorionic villi; anatomicropathologic studies of causes of placenta accreta, increta or destruens, *Ztschr. f. Geburtsh. u. Gynak.*, 108: 25–69, 1934.
8. Capecchi, E. Abandonment placenta accreta in uterus of patient who had had Cesarian section previously; return of uterus to normal state without complication; case. *Policlinico*, 40: (sez-prat), 347–349, 1933.
9. Giavotto, G. Placenta accreta partialis; case. *Folia Gynec.*, 29: 269–300, 1932.
10. Freitas Simoes. Placenta accreta in multiparous woman; surgical therapy; case. *Lisboa Med.*, 10: 414–427, 1933.
11. Solomons, B. and Bourke, F. S. Case of placenta accreta with pathological description. *J. Obst. & Gynec.*, Brit.-Emp., 40: 855–858, 1933.
12. Smith, R. K. Placenta accreta; report of a case with review of lit. *Southwest-Med.*, 17: 55–58, 1933.

REVERSED COLLES FRACTURE: CLOSED REDUCTION

SIDNEY S. GAYNOR, M.D.

Assistant Adjunct Orthopedic Surgeon, Hospital for Joint Diseases and Lenox Hill Hospital

NEW YORK CITY

RECENTLY Webb and Sheinfeld reported a case of reversed Colles fracture which could not be reduced by closed manipulation and had to be disimpacted by means of chisel-leverage following open exposure. A review of the literature by these authors did not reveal a single case in which a successful reduction was obtained by the closed method. They therefor concluded that such fractures should be considered irreducible except by operative means.

The successful management by closed manipulation of a case of reversed Colles fracture with the preoperative roentgenogram was presented by Roberts; but unfortunately postoperative films were not shown.

No adequate explanation for the failure of manipulative disimpaction of such fractures has been advanced, except by Hitzrot, who reported a case in which the sharp distal end of the proximal radial fragment was enmeshed in the annular ligament.

A case of reversed Colles fracture has been encountered by the author which yielded to closed manipulation, and, in view of the many communications to the contrary, merits report:

G. S., a fourteen year old schoolboy was seen on December 3, 1934, about six hours after a fall upon his plantarflexed left wrist. The left wrist and hand were so diffusely swollen as to prevent recognition of any of the bony landmarks. The left hand was maintained in marked plantarflexion and in moderate radial deviation; any attempt at altering this position was strongly resisted by muscle spasm. Palpation of the distal end of the radius caused excruciating pain. Roentgen examination revealed a complete oblique fracture of the anterior lip of the distal end of the radius with antero-radial displacement of the distal fragment, which contained most of the distal radial epiphysis. (Fig. 1.)

Under gas-oxygen anesthesia the hand could not be dorsiflexed beyond 180°. The impaction was then disengaged with comparative ease by increasing the plantarflexion of the hand. The reduction was completed by gradually bringing the hand up into extreme dorsiflexion, the thumbs of the operator pressing upon the distal fragment from its volar aspect while the assistants maintained traction upon the fingers and countertraction against the flexed elbow. The final position was retained by means of a lightly padded circular plaster-of-Paris cast extending from the proximal interphalangeal joints to just below the elbow. (Fig. 2.)



FIG. 1.



FIG. 2.

Postreduction roentgenograms revealed satisfactory reduction of the fracture. After two weeks an anterior molded plaster-of-Paris splint maintaining the wrist in 120° extension was substituted for the cast. In turn this was discarded at the end of a week, at which time the *x*-ray

[*Concluded on p. 163*].

PANCREATIC CONGESTION LIMITED TO CAUDAD PORTION

GEORGE FERRÉ, M.D.

LAUPAHOEHOE, HAWAII, T. H.

A FILIPINO laborer, aged thirty-five, was brought to the dispensary of the Laupahoehoe Sugar Company, at Papaaloa, Hawaii, on the morning of June 11, 1935, suffering with abdominal cramps, reported to be in a dying condition. Friends had brought him practically unconscious from one of the nearby laborers' camps.

Chief Complaint: Terrific pains in the upper left quadrant.

Present Illness: He had been at work the previous day, doing heavy manual labor. During the early morning hours of June 11, he was seized suddenly with such strong knifelike pains, continuous but nonradiating, that he fainted. Friends found him as he was reviving and brought him to the dispensary. There was no other localization of the pains. He said that it felt as though someone was turning a knife in his left side, while "squeezing" him in an "iron clamp." He felt very warm at first, but later very cold and weak. There was no vomiting during the first six hours of the attack, but seven or eight hours after the onset of the pains there was a mild regurgitation of bilious material. He complained that his head was "very heavy."

Past History: For the past ten years he has been a resident of Hawaii, before that time he lived in the Philippines. He has had some childhood diseases, and a few attacks of the common cold; otherwise his past history is entirely negative.

Family History: His father, mother and two brothers were living and well. There was no familial diseases in immediate family.

Physical Examination: A moderately well nourished Filipino, lying on his left side, moaning with pain.

His teeth are in poor condition, and the gums are soft and pale. The tongue is not unusual, and his throat negative.

The lungs sounds are normal; no rales heard. The heart borders are within normal limits. The apex beat palpable at the fifth interspace in the midclavicular line. No murmurs are heard. The pulse was 120 per minute when first seen, but in the course of an hour it came down to 84, regular and strong. His temperature was 103.0°F. by mouth.

The abdominal wall is well developed, and exceedingly muscular, with a distinct spasm over the left side, and a less perceived spasm on the right side. Some tenderness on palpation over the entire abdomen, but he was extremely tender in the left upper quadrant. The palpation and percussion were done with difficulty because of the pain and the moderate rigidity. There was no mass or hernia that one could palpate. The abdomen was not distended. There was no icterus.

Reflexes, sensations, and development of the extremities are normal.

Summary: A Filipino male complaining of severe pains in the upper left quadrant with negative examination except for a marked tenderness and rigidity with muscle spasm over the left upper quadrant, and temperature 103°F.

Progress: He was observed for ten days before operation. During this period, his temperature rose consistently to 101.5° in the afternoon from a morning temperature of about 99°F. His respiration varied from 20 to 30 per minute, and his pulse from 68 to 94. He continued to complain of severe pains in the left side, except on the fourth hospital day when he was free from pains. During this time, he was given

a light oriental diet, quite bland, no sedatives, and no other treatment but rest in bed.

On the eleventh hospital day he was seized with the same type of pain as on the day of admission. The white count was 18,000, with 78 per cent polymorphonuclear, the red count was 4,500,000. The urine was negative. His temperature was 99.6°, and his pulse was 80.

The only other remarkable feature was a marked loss of weight. He lost nearly twenty pounds in eleven days, in spite of a fair appetite.

Operation: Under ether anesthesia a large left rectus incision was made, and the accessible portions of the liver, spleen, and stomach explored. Numerous fatty placques were seen scattered over the gastrocolic ligament and the lower pole of the spleen. The kidney was palpated through the peritoneum.

The portion of the gastrocolic ligament within reach was divided and the tail and a part of the body of the pancreas exposed. The tail was seen to be swollen and glistening under the distended peritoneal covering (commonly called its capsule). The "capsule" was divided and three small Penrose drains inserted.

A right rectus incision was now made, and the gastrocolic ligament again divided. The edema of the pancreas ceased abruptly at a point close to an arbitrary line dividing the caudad portion of the organ from its body. The cause of the evident obstruction was not found after careful palpation. The organ itself was not explored surgically. This portion of the gastrocolic ligament was sutured, the gall bladder was inspected and palpated, and the incision closed without drainage.

The first incision was now closed, leaving the Penrose drains in situ.

Convalescence: This was entirely without incident. A slight fever on the second and third postoperative days (99.6°–100.8°) and some expected discomforts were the only features, the patient leaving the hospital on the twenty-first postoperative day. Ten weeks after the operation he returned to his former work. There has been no recurrence of symptoms.

SUMMARY

A case of possible obstructive pancreatitis is reported, which recovered after surgical intervention.

CONCLUSION OF DR. GAYNOR'S ARTICLE*

film revealed satisfactory callous formation. The patient was last seen March 4, 1935, when no limitation of carpal motion was found, nor was there any apparent or mensurable disturbance of growth resulting from the trauma sustained by the distal radial epiphysis.

CONCLUSIONS

1. A case of reversed Colles fracture successfully treated by closed manipulation is reported.

2. The impaction of the fragments appears to be the obstacle impeding reduction, and should be overcome by increasing the deformity manually before restitution of alinement is attempted.

REFERENCES

Bettman, R. B. and Tannenbaum, W. J. Reverse colles fracture—a plea for closed reduction. *Jour. Am. Med. Assn.* 105:2151 (Dec. 28) 1935.

Hitzrot, J. M. Transactions of the New York Surgical Society. *Ann. Surg.*, 61:740, 1915.

Raymer, J. G. Reversed colles fracture. Successful reduction by closed method. *Jour. Am. Med. Assn.* 105:2151 (Dec. 28) 1935.

Roberts, J. B. Notes on the Modern Treatment of Fractures, D. Appleton & Co. New York. p. 134, 1899.

Webb, G. & Sheinfeld, W. Reversed colles fracture with special reference to therapy. *J. A. M. A.*, 104: 2324 (June 29) 1935.

* *Continued from p. 161.*

TWO INTERESTING CASES OF FRACTURE OF STERNUM

W. K. JENNINGS, M.D.

Instructor in Surgery, Northwestern University Medical School; Assistant Surgeon, Evanston (Illinois) Hospital

WINNETKA, ILL.

TEXTBOOKS of surgery class fractures of the sternum as a rare entity. Papers by Ashhurst[1] in 1862, and Gurlt[2] in 1864, emphasized the infrequency of this injury during that period. Speed[3] in 1916 reported 12 cases in a series of 11,302 fractures seen at the Cook County Hospital over an eight year period. Stuck[4] studied the Mayo Clinic cases in 1934 and found that 8 of these fractures represented the total number seen. However, 4 of these had been treated the preceding year. Holderman,[5] in 1928, recorded 3 recent cases which he had diagnosed and treated.

Without doubt, the automobile and improved *x*-ray facilities and technique are bringing more of these fractures to the surgeon's attention. In one month we have encountered 2 cases of complete fracture of the sternum. The account of each is as follows:

CASE I. Mrs. L. L., age sixty-three years, entered the Evanston, Illinois, Hospital three days after an automobile accident in which she had been thrown violently against the back of the front seat. She had difficulty in recalling any of the details incident to the accident or the manner in which she was injured. First aid had been administered in an outlying hospital and the patient allowed to return to her home. Persistent pain in the back of the neck and shoulders prompted her to seek further medical counsel. When seen the symptoms were localized chiefly in the back of the neck. Respirations were not painful and there was no apparent limitation of expansion. The patient thought there was an abnormal forward angulation of the cervical spine. An *x*-ray of the latter failed to reveal evidence of bony injury. Improvement followed physical therapy treatments to the neck and back. The patient was discharged from the hospital after three days of observation. She returned two weeks later feeling much better but stated she had discovered a lump near the upper limit of the sternum. Palpation revealed an irregularity near the junction of the first and second parts of the sternum with overriding of the fragments, the gladiolus being displaced anteriorly (Fig. 1). There was no evidence of callus formation but absence of crepitus and pain suggested satisfactory healing. Three weeks later she was still symptom free.

CASE II. The second case was the result of a fall from a scaffold. Mr. A. P., age sixty-two years, entered the Evanston, Illinois, Hospital in moderate shock complaining of pain in the chest, anteriorly, difficulty in breathing because of painful inspiration and pain in the back. Physical examination revealed a deformity of the upper part of the sternum suggesting complete fracture with overriding of the fragments, the lower segment being displaced anteriorly (Fig. 2). Radiologic study confirmed the clinical examination. The only treatment employed was keeping the patient in the supine position for two weeks. It was felt that immobilization was contraindicated because of a preexistant bronchiectasis. After the first week practically all pain had disappeared. At the end of the third week the patient was walking about with little discomfort. Five weeks later the patient was practically symptom free.

Most accounts of the treatment of uncomplicated fractures of the sternum lack convincing authority. As in all fractures with displacement of the fragments, anatomical reposition followed by temporary immobilization represents the ideal treatment. Unfortunately, this is usually difficult of attainment in fractures of the sternum. According to certain writers, failure to obtain reduction by closed methods should be followed by an operation and the depressed fragment elevated by means of a hook, an elevator or some other mechanical devise. Holderman was able to obtain reduction in 2 of his cases by hyperextending the dorsal and cervical spine and exerting digital pressure over the projecting fragment. Partial immobilization was accomplished by applying a tight adhesive swathe around the upper chest

and keeping the patient in bed. Stimson[6] described a case in which reduction was effected after three days of simply keeping the patient recumbent with the head and shoulders thrown back.



Fig. 1.

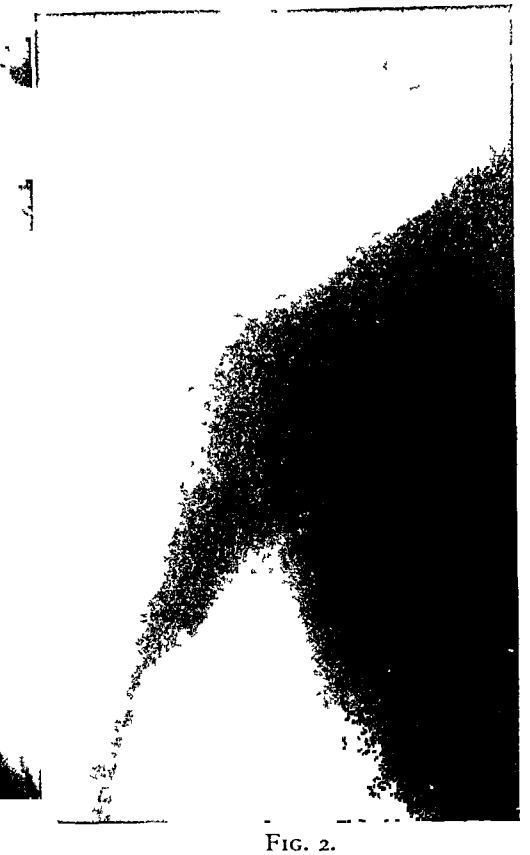


Fig. 2.

It is doubtful if present day authorities have added a great deal to Ashhurst's summary, published nearly a century ago, regarding the treatment of fractures of the sternum; "I should be governed by the same rules as in fracture of the skull with depression; if there were already an external opening, I should remove any loose fragments, and endeavor by appropriate means to restore the parts depressed to their natural position; but in the case of a simple fracture I should hesitate very much before resorting to any such heroic mode of practice."

It is quite likely that the advice of Ashhurst was tempered by his wholesome respect for the dangers attendant upon an open reduction of a simple fracture at that stage of the development of surgery. Nevertheless we must conclude that in his experience nonreducible, but uncomplicated, fractures of the sternum healed without difficulty.

While it is admitted that 2 cases are inadequate to justify any dogmatic conclusions, it is felt that they lend further emphasis to the value of conservative treatment in such conditions.

SUMMARY

Two cases are reported of complete fracture of the sternum with moderate displacement of the fragments in which a good functional union was obtained without manipulation or immobilization.

REFERENCES

1. Ashhurst, J. On fracture of the sternum, *Am. J. M. Sc.*, 44· 406–413, 1862.
2. Gurlt: Cited by Holderman.
3. Speed, K. A Textbook of Fractures and Dislocations, Phila., Lea and Febiger, p. 345, 1916.
4. Stuck, Water G. Fractures of the sternum, *Am. J. Surg.*, 22: 266–270, 1933.
5. Holderman, H. H. Fracture and dislocation of the sternum, *Ann. Surg.*, 88: 252–259, 1928.
6. Stimson, L. A. A Practical Treatise on Fractures and Dislocations, Ed. VII, Philadelphia, Lea & Febiger, p. 194, 1912.

GALLSTONE OBSTRUCTION OF BOWEL

A. A. SKEMP, M.D. AND F. G. TRAVNICEK, M.D.

LA CROSSE, WISCONSIN

THE etiology of bowel obstruction is frequently obscure and frequently regardless how thorough and painstaking the investigation, one is surprised when the ultimate cause is uncovered either at operation or at postmortem examination. A case recently under observation had certain features of rather unusual interest and seemed worth while recording.

A female patient, aged seventy-two years, entered the hospital complaining of nausea, persistantly increasing vomiting and epigastric pain of three days duration. She was perfectly well prior to onset of these symptoms. Two years previously she had a similar attack which lasted for two weeks. She had had no gall-bladder colic, jaundice or vomiting of blood. In the past, there have been attacks of diarrhea which lasted only a day. She has had food dyscrasia. Recently there has been some swelling of the ankles and shortness of breath. On physical examination patient was found to be obese and seemed quite dull mentally. Temperature, pulse and respiration were normal. The heart and lungs were normal. The abdomen was very much distended with marked tenderness in the right lower quadrant. There was ankle edema. Blood pressure was 172/70, the urine was scanty and showed a trace of albumin and some white blood cells. Two white blood counts showed leucocytosis of 15,000 and 12,000. Non-protein nitrogen 97 mgm. per 100 c.c. of blood. Patient refused surgery. Hot turpentine stupes were applied, milk of molasses enema given and the Wangensteen method of siphonage was used to control the vomiting and reduce the distention. The second day after admission the patient was comatose, the distention increased and she died the fourth day after admission.

The postmortem findings are reported from the records of Dr. E. Thurston, resident pathologist.

Body is that of a well nourished elderly white female. Livor mortis is present in the dependent parts. There is a huge distention of the abdomen. There is a moderate pitting edema of the ankles.

Abdominal Cavity: Upon opening the abdomen the greatly distended loops of small intestine force their way into the incision. These loops are markedly engorged, and from the serosal surface small quantities of fibrin may be scraped. There is no free fluid or gas present.

Thoracic Cavity and Organs: Both lungs are bound down on all surfaces by old adhesions. There is no free fluid in either pleural cavity. On section, the lungs are crepitant, with a few areas of atalectasis. There is no free fluid in the pericardial cavity, and no changes are noted in the endocardium except for a slight degree of thickening of the aortic cusp of the mitral valve. Myocardium is firm. There is a slight degree of fatty infiltration into the right heart muscle. There is a slight degree of arterio sclerosis of the coronaries and aorta.

Abdominal Organs: The previously described degree of distention is found to end abruptly about 20 cm. proximal to the ileocolic valve in the ileum. Distant to this point the ileum is apparently of a normal appearance. A firm mass lying within the lumen of the ileum at this point is found to be the cause of the distention.

Stomach: No changes are noted in the stomach except for a slight degree of congestion. The mucosa of the duodenum is hyperemic and shows many petechial hemorrhages.

Gall bladder is found adherent in the first part of the duodenum. Upon opening the duodenum a fistula is found between the fundus of the gall bladder and the lumen of the duodenum. This opening is approximately one centimeter in diameter. Upon opening the gall bladder, several small stones are found in the contracted sac. The ampulla of Vater is found to be patulous and shows the signs of the previous passage of gallstones by the tears in the walls. The common bile duct is opened and no changes noted in the hepatic ducts. The cystic duct is found and dissected, it ending blindly at its junction with gall bladder.

Jejunum and Ileum: The mucosa of the opened jejunum and ileum everywhere is markedly engorged and shows in many places small spherical ulcers. Dissecting down to the point of obstruction the cause is found to be a gallstone, measuring 4 cm. in length and 2 cm. in breadth. At the point of impaction, the mucosa is markedly ulcerated. No changes are noted in the colon.

Kidneys are somewhat larger than usual, the capsules of each stripping easily but the surfaces are finely scarred and several small cysts are noted. On section there seemed to be a thinning of the cortex. There is granular appearance and irregularity of the columns of glomeruli. There is an increase in the peripelvic fat. No changes are noted in the ureters or bladder.

Ovaries are atrophic; the uterus is small and hard.

Provisional Anatomic Diagnosis:

1. Old cholecystitis and cholelithiasis.
2. Cholecystoduodenal fistula.
3. Acute intestinal obstruction due to gallstones.
4. Toxemia.
5. Chronic parenchymatous nephritis.

We have reviewed a series of cases recently reported in various journals and have noted the features of interest which are prominent in the symptomatology and treatment of the cases. It is obvious that the mortality rate is extremely high as the diagnosis is practically never made accurately, although obstruction of the bowel is generally suspected. One very outstanding feature in recounting the case protocols has been that very frequently there has been no history of either gall-bladder colic or gall-bladder dyspepsia, and very frequently likewise "scout plates" of the abdomen have failed to reveal gallstones.

In our own case the history of gall-bladder disturbance was inadequate for diagnosis, the opening between the gall bladder and the duodenum was scarcely more than one centimeter in diameter. The common duct was small and constricted but this huge gallstone could find an unphysiologic exit from its habitat in the gall bladder and still obstruct the bowel and cause death. This occurred in a portion of the bowel where distensibility is great and where there is no sphincteric action to be responsible for the obstruction.

Reference has been made to the passage of large gallstones through the common duct causing obstruction of the small bowel. Still we could find no example of this type of stone migration. The stones generally recorded have been of more or less uniform size of 3 to 4 cm. The mortality, although unusually high, seems to depend in a measure on several factors. The first and foremost is the failure of diagnosis. The symptomatology is not fulminating enough to persuade the patient to consult the doctor early and the doctor has frequently procrastinated because of the unusual features which generally present themselves at the time of the first examination. Frequently the obstruction at first is only partial and this is often misleading. The second factor in the high mortality rate is the role played by the various degenerative diseases we found in these senile patients. Perforations and peritonitis have likewise been the cause of death.

In our patient the initial examination was made three days after the onset of the symptoms, and although obstruction of the bowel was diagnosed, the patient refused surgery. Preoperative diagnosis did not consider gallstone obstruction but rather a large bowel malignancy. There seems no reason why a reasonably low mortality cannot be obtained in the operative management of these cases if it is felt that the obstruction of the bowel means surgery and that this should be instituted as soon as possible after the onset of symptoms. The comatose condition of our patient and the high non-protein-nitrogen content of the blood, made us feel that uremia was developing, but it should not be forgotten that the bowel obstruction is featured by blood chemistry of that type and should not be considered too seriously in the appraisal of the operability of the case.

In conclusion, gallstone obstruction should not be forgotten in obese individuals with a mild evolution of obstructive symptoms even though there is no past history of gallstone colic or of gall-bladder dyspepsia. *X*-rays will not make the diagnosis which will always be tentative until the visual examination at the operative table or postmortem examination.

REFERENCES

Gardiner, H. Intestinal obstruction due to gallstones. *The Lancet*, (Aug. 12) 1933.

Johns, Joseph. Intestinal obstruction due to impacted gallstones. *Jour. of Mich. St. Med. Soc.*, (March) 1933.

Marshal, V. F., Heitmeyer, P. L. and Swanton, M. E. Intestinal obstruction due to gallstones. *Wisc. Med. Jour.*, (Jan.) 1931.

Angle, Lewis W. Acute intestinal obstruction caused by impacted gallstones. *Am. J. Surg.*, (Sept.) 1932.

Van Ravenswaay, Alex. Acute intestinal obstruction by large gallstone. *Am. J. Surg.*, (April) 1932.

Aldrich, J. F. and Barnes, Benjamin S. Obstruction of the small intestines due to gallstones. *Jour. Iowa St. Med. Soc.*, (Feb.) 1933.

Vidgoff, Jack. Acute intestinal obstruction due to gallstones. *Am. J. Surg.*, (March) 1933.

Junkin, H. D. Obstruction due to gallstones. *Am. J. Surg.*, (March) 1933.

Rosenthal, Eugene. Intestinal obstruction caused by impacted gallstones. *The Lancet*, (July) 1934.

McWhorter, Golder L. Acute obstruction of the small intestine due to a gallstone. *Arch. Surg.*, (Nov.) 1929.

Cook, P. H. and Watkins, Royal P. Recurring intestinal obstruction by gallstones. *New England Jour. Med.*, (Sept. 8) 1929.

Hennesy, M. C. Intestinal obstruction due to a gallstone. *Jour. Iowa St. Med. Soc.*, (Nov.) 1934.

Curry, J. G. Gallstone intestinal obstruction. *Jour. Mich. Med. Soc.*, (Jan.) 1931.

Diack, Samuel L. and Fagan, Edwin P. Intestinal obstruction due to gallstones. *Surgical Clinics of North America.* (Dec.) 1934 (Pacific Coast).

Cabot, Richard, C. An abdominal emergency with vomiting and epigastric pain in a woman of 77. *New England Jour. Med.*, (March 2) 1933.

Jackson, J. A. and Ewell, G. H. Acute intestinal obstruction due to a large gallstone. *Wisc. Med. Jour.*, (Nov.) 1930.

REFERENCES OF DR. THOMAS*

7. Widenmann, A. Ueber partiellen Riesenwuchs. *Beitr. z. Klin. Chir.*, 8: 625–638, 1891–1892.
8. Stier, E. Über Hemiatrophie und Hemihypertrophie nebst einigen Bemerkungen über ihre laterale Lokalisation. *Deutsche Ztschr. f. Nervenheilk.*, 44: 21–64, 1912.
9. Wieland, E. Zur Pathologie der dystrophischen Form des angeborenen partiellen Riesenwuches. *Jahrb. f. Kinderh.*, 65: 519–584, 1907.
10. Cohnheim, J. F. Lectures on General Pathology, 1889–1890.
11. Wagner, P., Zur Casuistik des angeborenen und erworbenen Riesenwuches. *Deutsche Ztschr. f. Chir.*, 26: 281–306, 1887.
12. Hagen, F. B. Ueber Knocken- und Gelenkanomalieen, insbesondere bei partiellem Riesenwuchs und bei multiplen cartigaginären Exostosen., *Arch. f. klin. Chir.*, 41: 420–466, 1891.
13. Kitaigorodskaja, O. D. Angeborene Hypertrophie im Windesalter. *Jahrb. f. Kinderh.*, 125: 38–89. 1929
14. Broca and Massonaud. *J. Physiol.* Brown-Sequard, 1859.
15. Caubet, H., and Mercadé, S. Hypertrophie Congenitale des Orteils. *Rev. de chir.*, 29: 86–104, 493–509, 613–627, 1904.
16. Spreitzer, O. H. Congenital partial gigantism; gigantism of feet. *Ztschr. f. orthop. Chir.*, 58: 423–431, 1933.
17. McFarland, B. L. Hemihypertrophy. *Brit. M. J.*, 1: 345–346, (Mar. 3) 1928.
18. Lisser, Hans. Congenital total hemihypertrophy, *J. A. M. A.*, 82: 1046, (Mar. 29) 1924.
19. Wakefield, E. G. Unilateral, congenital hypertrophy, involving right side of a female aged six. *Ann. Int. Med.*, 1: 292–296, (Nov.) 1927.
20. Pires de Lima, J. A. Macrodactyly of toes; case. *Ann. d'anat. path.*, 4: 219–221, (Feb.) 1927.
21. Curri, D. Megalosyndactylia of foot; case. *Chir. d. org. di movimento*, 18: 243–248, (Sept.) 1933.
22. López, R. Vara. Congenital megalodactylia; case. *Progresos de la clin.*, 42: 96–99, (Feb.) 1934.
23. Dombrovsky, A. I. Megalosyndactylia; case. *München. med. Wchnschr.*, 75: 1503, (Aug. 31) 1928.
24. Ymaz, J. I. Macrodactyly; pathogenesis and surgical therapy; case. *Hosp. argent.*, 3: 1100–1103, (June 15) 1933.
25. Westergaard, O. H. Megalodactylia of right foot, *Med. rev.*, 51: 62–67, (Jan.–Feb.) 1934.
26. Tatafiore, E. Congenital macrodactyly; case. *Pediatria*, 42: 405–412, (April) 1934.
27. Aloi, V. Case of giant toe. *Riforma med.*, 43: 79, (Jan. 24) 1927.
28. Bujwid, O. Rare monstrosity of foot (macrodactyly); case. *Polska gaz. lek.*, 6: 960, (Nov. 20) 1927.
29. Yokota, K. Syndactylia combined with macrodactyly in patient with fibrolipoma of right foot. *Taiwan Igakkai Zassbi* (Abstr. Sect.), 33: 5, (Feb.) 1934.

* *Continued from p. 112.*

MYXOSARCOMA OF PROSTATE*

WM. ROSENBERG, M.D., F.A.C.S.

Associate in Urology, Mt. Sinai Hospital

CLEVELAND, OHIO

NEOPLASMS of the prostate of mesothelial origin are rare and myxosarcoma is one of the less common forms of sarcoma of the prostate. Tumors of mesothelial origin may also arise in the bladder or in the retrovesical tissue, surround and invade or even destroy the prostate so that late in the disease their origin cannot be determined. To be certain of the prostatic origin of sarcoma, when studied the tumor must be sufficiently circumscribed and limited in its extent so that there can be no doubt as to its origin. In the case herein described, the prostate per rectum disclosed the gland to be the seat of an inoperable malignancy and cystostomy showed the tumor to be limited at the time to the prostate only.

CASE REPORT

History: A. G., a white male, age forty-six years was first seen November 22, 1933, complaining of difficulty in urination. Three weeks prior to being seen, he had had two attacks of acute retention for which he had consulted a chiropractor who made a diagnosis of prostatitis. Resort to catheterization was made and prostatic massage instituted with some relief. Several weeks after the onset of the symptoms, the patient noted a bulging in the perineum and he was unable to sit down without excruciating perineal pain on the right side.

Family History: Mother died many years ago following cholecystectomy. Father is living and well. Patient has been married seventeen years, wife and two children living and well.

Past History: The patient had the usual childhood diseases, influenzal pneumonia in 1916 and 1918. Six years ago patient developed diabetes mellitus which was easily controlled by diet. At the onset of his diabetes the patient weighed 207 lbs. and at the present weighs 157 lbs. The latter weight has been maintained for the past several years. Insulin has not been employed at any time. About a year ago, patient developed otitis media which subsided without complication.

Physical findings were entirely negative except for the rectal examination. The prostate was so tremendously enlarged the examining finger could not reach the upper border. The mass was soft and doughy in consistency and firmly adherent to the rectal wall although the borders were sharply defined. There were no areas of fluctuation and no history of urethritis. The seminal vesicles were not palpable. Temperature was normal although fever of low degree was present during the previous three weeks.

The patient was again seen at his home on November 27, at which time the temperature was 102. Catheterization was necessary intermittently and when complete retention occurred the patient was placed on constant drainage per urethra.

Rectal examination on December 4 showed the mass to have increased somewhat in size and there was now palpable a firm nodule about 2 cm. in diameter in the left lobe of the prostate. A diagnosis of an inoperable malignancy of the prostate was made at this time, its exact nature being undetermined but apparently not a carcinoma. Cystoscopy was attempted on December 12, but the cystoscope could not be passed because of the obstructing mass in the posterior urethra. The patient was again seen December 29, 1933, and deep therapy was advised inasmuch as the tumor was inoperable. A diagnosis of a possible sarcoma of the prostate was made.

Patient was admitted to Mount Sinai Hospital on December 30, 1933, for deep therapy. He appeared acutely ill and obviously in great pain. There was marked tenderness on pressure in the region of the bladder. On rectal examination the prostatic mass appeared to have increased in size on the right side, the nodule on the left side showed no change, was entirely immovable and firmly attached to the rectal mucosa. Twelve deep therapy treatments were

* From the Department of Urology, Mt. Sinai Hospital.

given encircling the entire pelvis with the following factors: 200 K.V., 0.75 mm. Cu. plus 1 mm. Al. Filter; 450 or ½ S.U.D. through each portal. The last treatment was administered on January 13, 1934. On January 28, the tumor was apparently the same in size, the nodule previously described very firm, and the general condition of the patient unchanged. Following deep therapy, the patient was able to void without the aid of a catheter.

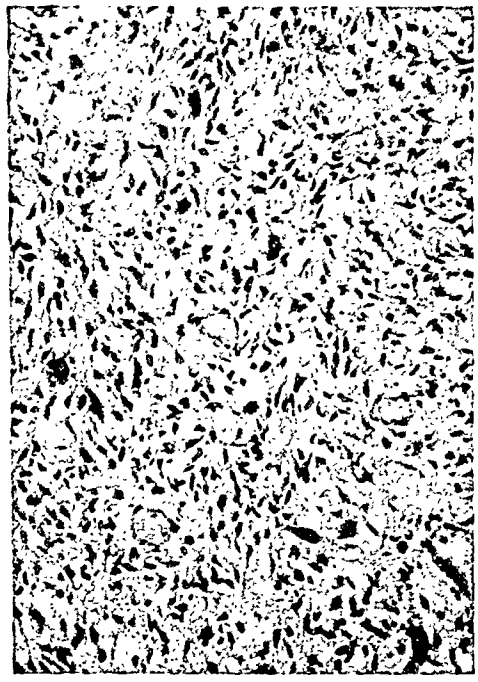


FIG. 1. Myxosarcoma of prostate. (120 ×)

On February 15, the patient developed a thrombosis of the dorsal vein of the penis with marked edema. The tumor mass was larger, firmer and completely adherent. On February 27, acute retention again occurred and cystostomy was advised. Patient was readmitted to the hospital on March 1, for suprapubic cystostomy and radium.

Operation: Suprapubic cystostomy was performed on March 3, 1934. The prostate was tremendously enlarged, very nodular, irregular and covered by intact mucosa. Many of these nodules were cystic on palpation. A portion of the tumor mass was removed with the Bovie. Grossly, the tissue appeared cystic and gelatinous. The cysts were filled with a mucoid substance. Radon seeds were then inserted into various portions of the prostate at different levels. The bladder was closed in the usual manner and the patient was discharged from the hospital on March 17 with permanent suprapubic drainage.

X-ray Report: Roentgenograms taken December 30, 1933, and subsequently during the course of the disease never disclosed any evidence of metastases to the lumbar spine, pelvis, or chest.

Laboratory Findings: The urine was persistently alkaline in reaction with marked albuminuria and no sugar. Microscopically much pus was present. The white blood cell and the red blood cell counts were normal.



FIG. 2. Gross photograph showing external surface of myxosarcoma of prostate. Tumor masses from pelvis and large intestine.



FIG. 3. Gross photograph showing cut surface. Markers indicate ureteral orifices.

Blood chemistry findings were normal on several occasions.

**Pathological Report:* Grossly the specimen consists of a small mass of tissue measuring 15 × 12 × 10 mm. On the external and cut surfaces the tissue is fleshy, grey, semitranslucent and of fine architecture. In places there are areas of reddish brown discoloration.

Microscopic Description (Fig. 1). No prostatic tissue is present. The tumor is made up of spindle shaped cells with abundant lavender stained cytoplasm. The nuclei of the tumor cells vary considerably in size and shape, the majority are spindle shaped to stellate. Many of the nuclei are large and hyperchromatic. There are a moderate number of mitotic figures present and numerous thin walled blood vessels.

Diagnosis: Myxosarcoma of prostate.

Patient died June 12, 1934. Partial autopsy was obtained. Emaciation was very marked and there was a tremendous suprapubic mass and also a marked protuberant mass in the perineum. Upon making a suprapubic incision, the bladder could not be visualized because of the extent of the neoplasm. As much of the tumor was removed as was possible. The entire pelvis was "frozen" and the tumor tissue was removed with the greatest difficulty. A smaller mass entirely separate from the main tumor was adherent to the large bowel, was easily removed. The kidneys and ureters were normal in size and appearance. There was no adenopathy.

**Pathological Report:* The gross specimen (Fig. 2) consists of two masses of tissue removed postmortem. The larger mass weighs 1600 grams, measures 20 × 16 × 11 cm. and filled the entire pelvis. The smaller mass was attached to the large intestine and measures 6 × 5 × 3.5 cm.

On exploring the larger mass (Fig. 3) the lower portion of the bladder and the ureters are found surrounded by and infiltrated by tumor. The ureters, however, are patent. The tumor mass is of fine architecture, fleshy consistency, greyish white, shows considerable degenerative changes with numerous irregular defects and areas of reddish brown and yellow discoloration suggesting areas of hemorrhage and necrosis.

There is a small amount of prostatic tissue still recognizable at the neck of the bladder. Elsewhere the prostate is entirely replaced by tumor. There are several gold radon seeds in the tumor mass at the neck of the bladder with slight regional reddish brown discoloration.



Fig. 4. Magnification 6×. Prostatic tissue in right lower section. Myxosarcomatous tissue left upper section.

The seminal vesicles are not distinguishable. The urethra is still recognizable in the intact prostatic tissue and continues to the edge of the specimen as a dilated and tortuous structure lined by tumor tissue. There is a portion of the rectum attached to the posterior surface of the mass.

Microscopic Description: (Fig. 4) Three sections show a striking picture. The tumor tissue is composed of adjoining immature fibroblastic cells, with abundant faintly blue stained cytoplasm. The nuclei vary in size in different portions, with occasionally multiple nuclei. In places there is necrosis of tumor tissue. The tumor tissue is observed extending into fibrofatty tissue in one section. Prostatic tissue is recognizable in the lower right portion of the section. Section of the smaller mass attached to the large intestine shows a similar picture. Larger magnifications show sections to be similar to Figure 1.

Final Diagnosis: Myxosarcoma of the prostate, 20 cm. in diameter.

[*Concluded on p.* 185.]

* Pathological Reports by Dr. B. S. Kline and Dr. A. M. Young.

STRUMA LYMPHOMATOSA (HASHIMOTO)

REPORT OF A CASE*

D. HENRY POER, M.D., F.A.C.S., T. C. DAVISON, M.D., F.A.C.S., AND E. L. BISHOP, M.D.

ATLANTA, GA.

SINCE Hashimoto[1] in 1912, first described "a characteristic kind of chronic inflamation" of the thyroid, which he concluded was not in the same category with Riedel's[2] "eisenharter strumitis," there has been considerable controversy as to the actual existence of such a condition as a separate and distinct disease. It is unfortunate that the material for study is confined to a comparatively small group of cases, many of which are incomplete in essential detail; that all authentic cases may be available for study is the purpose of our presentation of this case. There are also several unusual features of interest.

For ten years following Hashimoto's first description there apparently is no mention in the literature of this interesting condition of the thyroid until 1922 when Ewing[3] suggested that struma lymphomotosa was an early stage of Riedel's struma. He states, "that in the early stages the gland is thickly beset with numerous lymph follicles with active germ centers, the reticulum of which become so numerous as to suggest lymphosarcoma—all stages of atrophy of the alveolar epithelium can be traced. Fibrosis and hyaline transformation begin early and eventually, as in Riedel's case, the enlarged gland becomes very firm and dense. It appears therefore that Hashimoto and Riedel have described the early and late stages of the same pathological process."

In 1925 Williamson, Scott, and Pearse[4] studied 2000 specimens of thyroid glands in England, and described the distinctive pathological changes of struma lymphomotosa which they called "lymphadenoid goiter." McCarrison[5] in 1929 was able to produce a condition simulating this in rats by feeding a diet of American white flour, meat residue, olive oil, and table salt containing potassium iodide. Joll[6] in his recent book discussed lymphadenoid goiter which he considered to be an entirely different disease from Riedel's struma. Graham and McCullah[7] reported 4 cases in 1931 which they considered to be Hashimoto's type of struma lymphomotosa.

In the same year (1931) Graham[8] made a thorough review of all the cases available in the literature at that time and found 104 cases which he classified into ten groups. Of these, 41 were classified as Riedel's type of iron hard strumitis, and 24 fulfilled the requirements for Hashimoto's struma lymphomotosa. The remainder of 39 were excluded as not being typical of either. Graham then compared these first 65 cases very carefully in every detail and was able to define a clearcut conception of each. Briefly he says that Riedel's struma "may be looked upon as having a local inflamatory process in the thyroid for which an etiological factor should be sought. The general body economy is affected secondarily by reason of destruction of the thyroid, interference with respiration and deglutition, and injuries to important blood vessels and nerves. Hashimoto's type of lesion may be considered to be a local manifestation of a constitutional disorder—the changes in the thyroid tend to become degenerative rather than inflamatory and sclerosing—etc."

Foot's[9] ideas about these two conditions apparently is much the same. He states that "Hashimoto's struma has no connection with Riedel's struma, and that they

* From the Surgical Service, Georgia Baptist Hospital.

represent two distinct processes—the one an overgrowth of lymphoid tissue followed later by fibrous invasion that may be more



Fig. 1. Fig. 2.

Fig. 1. Gross specimen, anterior surface.
Fig. 2. Gross specimen, posterior surface.

a metabolic than an inflammatory process —the other a fibrous overgrowth in response to some inflammatory stimulus. In Hashimoto's disease we have the lymphoid tissue growing as lymph follicles among the parenchymatous portions of the gland and crowding it out in that way but without the enormous fibrous reaction of Riedel struma. In the latter the fibrous overgrowth seemed to strangle the parenchyma slowly but certainly until it underwent almost total atrophy and was replaced by dense woody masses of connective tissue. The lymphocytic invasion in that case consists more of lymphocytes than of lymphoid tissue with germinal centers as is seen in Hashimoto's struma."

On the basis of these concepts few reports of true Hashimoto's struma lymphomotosa have appeared in the literature since 1931. Eisen[10] presented 4 cases of Riedel struma and 3 cases of Hashimoto's struma in 1934 from the service of Dr. Emil Goetsch in Brooklyn; he considers these to be different phases of the same pathological process. Polowe[11] reported an interesting case in the same year of Hashimoto's struma clinically associated with hyperthyroidism, but his microscopic sections did not seem to bear this out pathologically. Howard[12] has recently added 2 cases to the literature from his experience in Boston; one of these was discovered at autopsy examination. Hertzler[13] in his recently revised monograph, describes Riedel's struma as a type of acute diffuse thyroiditis, and Hashimoto's struma lymphomotosa as a chronic thyroiditis which is localized within



Fig. 3. Giant lymph follicle with well developed germinal center. (×85.)

the capsule (intracapsular). He states that these two conditions "differ chiefly in extent of involvement while they are identical in structure."

CASE REPORT

History. On January 10, 1935, J. L. C., a white female aged thirty-five, came to the office of Dr. T. C. Davison complaining of a goiter and nervousness. She had been quite nervous for the past four years but did not notice the goiter until two months ago and thinks that it is growing. During the same period she has noticed some tightness in her throat with difficulty in breathing and swallowing. There has been no palpitation or other cardiac symptom; the appetite is normal but unable to eat certain foods and sweets. She has much gas but no nausea; diarrhea occasionally. There is no history of goiter in the family. She was born and reared in Georgia, is married and has one child living; no miscarriages. Thinks she has lost some weight lately.

Examination. The patient is of medium statue and weighs 142 pounds. The tonsils are enlarged and cryptic, with evidence of chronic infection. Pupils are equal and react normally; no eye signs of hyperthyroidism are present. The thyroid is quite prominent with equal enlargement of both lobes; the surface is

smooth and no nodules can be felt, no thrill or bruit present. The skin is of normal texture; the palms are warm and slightly moist. There

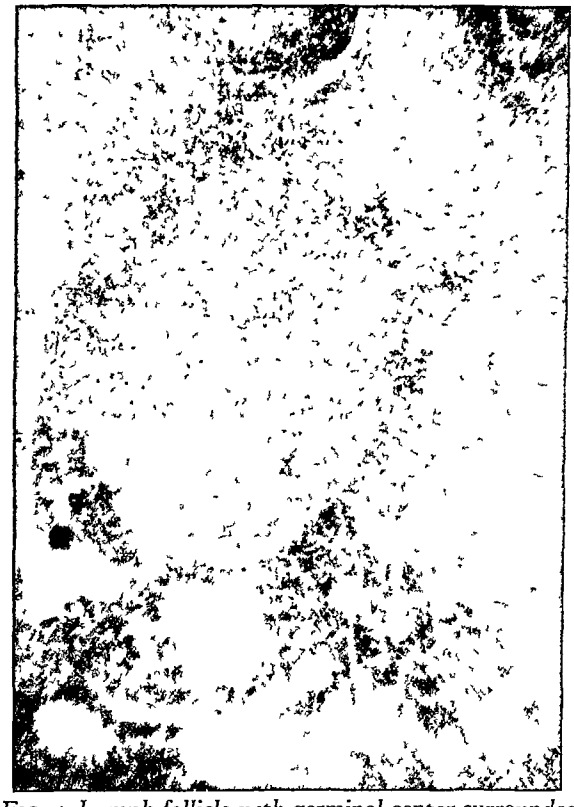


Fig. 4. Lymph follicle with germinal center surrounded by occasional contracted acinus. (× 75.)

is a slight tremor of the outstretched fingers and tongue. Breath sounds are normal, and no râles, friction rubs, or murmurs could be heard. Vocal cord movements normal. Roentgenograms showed no evidence of substernal extension or deviation of the trachea.

Her temperature was 98.6 (F), the pulse 86, blood pressure 120 systolic and 86 diastolic.

Laboratory Findings. Specific gravity of the urine 1.006, contains a trace of albumen, and 10–12 epithelial cells per high power field. Wassermann reaction is negative. Red cells numbered 3,840,000; white cells 9200; hemoglobin 75 per cent Sahli. Differential smear showed 57 per cent neutrophiles, 39 per cent lymphocytes and 4 per cent eosinophiles. The basal metabolic rate was minus 3 per cent.

Operation. She entered the Georgia Baptist Hospital on March 27, 1935 and on the next day a subtotal lobectomy was done on both sides. The area was infiltrated with ½ per cent procaine hydrochloride solution. A low collar incision was made and the muscles separated in the midline. Both lobes were found to be about three times the normal size; they were delivered without difficulty except for many



Fig. 5. Edges of follicle with diffuse lymphoid infiltration, atrophy and disappearance of acini (× 85.)

fine adhesions to the sternothyroid muscle. Approximately five-sixths of each lobe was resected. A soft rubber protective drain was placed to the stump on each side and closure done in layers.

Pathology. (Dr. A. J. Ayers). Specimen consists of two lobes and the isthmus of the thyroid. Size 10 × 5 × 3 cm., weight 160 gm. The surface of the right lobe is smooth, but on section there is an indefinite nodule filling the lower pole area. Color of the tissue is pale grayish pink, and the consistency is rather soft. The left lobe is the same except there is no nodulation. Capsule is intact. No cysts, hemorrhage, or areas of calcification seen. (Figures 1 and 2.)

Microscopic. (Dr. E. L. Bishop.) Sections taken from various portions of the thyroid show essentially the same structure in the different areas with minor variations. The most striking feature is the presence of a great many well formed lymph follicles with active germinal centers (Figures 3 and 4.) These follicles vary considerably in size, some being very small, others larger than a low power field. Under the microscope no field examined is without one or more of these lymph follicles. There is also a diffuse lymphoid infiltration of the entire gland. The epithelial structures are entirely passive and the acini show various stages of atrophy,

apparently from the pressure of the lymph tissue (Figure 5). The acini are mostly of small size although some of the individual cells show some swelling. Colloid is present in some of the acini and absent in others. Connective tissue formation is rather scanty in this particular specimen, in some areas there being a few bands or bundles, while in the greater portion there is only a fine supporting connective tissue. There is no evidence of active infection; cystic degeneration and adenomatous formation are absent. Vascularity is moderate but there is no hemorrhage. Giant cells and pseudotubercle formation are absent.

Diagnosis. Struma lymphomotosa (Hashimoto).

Postoperative Course. The immediate postoperative convalescence was uncomplicated. The drain was removed on the second day and the patient left the hospital on the seventh day. The wound healed per primum. It is now twelve months since operation and she has remained entirely well. However she is gaining weight and developing other signs of hypothyroidism. The basal rate is practically the same as before operation, minus 2 per cent.

DISCUSSION

On the basis of the signs and symptoms presented, it would seem difficult to have even suspected the true diagnosis in this case. And even after the examination of the gross specimen as removed at operation the soft consistency of the tissue caused no one to consider this type of struma which is usually characterized by a hardness that is extreme in some cases. Therefore we would differ with Graham[8] when he states that the diagnosis should be made upon the clinical and gross findings. It seems that the histology of benign granuloma of the thyroid is quite distinctive in spite of the fact that well formed lymph follicles are found in other pathological conditions of the thyroid, especially in toxic goiter. However, one must realize that in toxic goiter the glandular elements are extremely active, there being a definite hyperplasia, whereas in Hashimoto's struma the glandular structure is entirely passive and eventually disappears even before fibrosis occurs. In many cases it would appear that a dense fibrosis and "ligneous" type of thyroid gland such as described by Riedel follows the lymphoid type of Hashimoto.

On the other hand, some of the cases described as struma lymphomotosa fail to show evidence of conversion from a lymphoblastic to a fibroblastic type of structure. Lymph follicles are not present in the normal thyroid, there being only a scattering of lymphocytes in the stroma. It must be assumed that the newly formed follicles develop from the existing lymphocytes and it may be possible that the lymphoid type of gland represents a sort of "lymphadenitis of the thyroid" with the formation and proliferation of lymphocytes and lymph follicles, the tremendous overgrowth causing a destruction of the parenchyma of the gland.

Assuming that this is a low grade inflammation or thyroiditis as is fairly generally accepted, it is possible that after a variable period of time the active lymph tissue becomes exhausted and then follows a proliferation of the connective tissue eventually involving the entire gland. In this way might be explained the two entirely different structures present in different glands, which are believed by some to be early and late stages of the same disease.

SUMMARY AND CONCLUSIONS

A case of true struma lymphomotosa of the Hashimoto type, which fulfills all the accepted requirements for this diagnosis, is presented in detail, and the clinical and pathological features are described. As this is one of the youngest patients in which this condition has been found, and as the goiter had existed for a short period of only two months, the pathology probably represents the very earliest stages of this condition. The relationship of this type of struma to Riedel's iron hard struma, and a theory as to the explanation of this unusual pathological process is discussed.

[*For References see p. 185.*]

ACUTE INTUSSUSCEPTION IN EARLY WEEKS OF LIFE*

J. M. MORA, M.D., F.A.C.S. AND L. J. ARIES, M.D.

CHICAGO

ACUTE intussusception is essentially a disease of infancy, the vast majority of cases occurring within the first two years of life and most frequently between the fifth and twelfth months. The disease is apparently rare within the first few weeks of life, comparatively few cases being recorded where the diagnosis was confirmed by laparotomy or necropsy. Still rarer are the infants under twelve weeks of age who successfully withstood surgical intervention.

One of the earliest collected series was that of Hirschsprung,[1] who, in 1895 reported 64 cases, 46 of whom were under one year. The youngest was forty-nine days old and one was fifty-eight days old. No details are given of the individual cases. Hess,[2] in 1905, reported 1028 collected cases. Of 314 in whom the age was given, 8 occurred within the first three months. The 2 youngest each aged six days, died, irrigation only being tried; 3 others of this group were operated, 2 of whom recovered. Clubbe's[3] series of 144 patients did not include one under three months of age. Fitzwilliams,[4] in 1908, collected 1000 cases from the records of the Hospital for Sick Children, The West London Hospital and from the published statistics in the Lancet and The British Medical Journal, from 1891–1908, and from the Transactions of The Clinical and Medical Societies and The Society for the Study of Disease in Children. Only 4 cases appeared before the third month. The disease occurred most commonly between the fourth and seventh months. Inclusive of the 466 cases under one year of age, 64 per cent fell within this period. None of Hipsley's[5] 51 patients was under three months. Perrin and Lindsay,[6] in their monograph based on 400 cases, stated that the vast majority occur during the first two years. Of the 400 patients, 314, or 78.5 per cent, were under two years, while 279, or 69.75 per cent were under one year; and 203, or 72.7 per cent occurred between the fifth and ninth months. Only 9 patients of the entire series were under three months of age. Monrad,[7] physician in chief to the Dronning Louise's Children's Hospital in Copenhagen, in a twenty year period, 1906–1925 saw 115 cases of acute intestinal invagination and only one occurred within the first twelve weeks of life. Of the 363 cases admitted to Guy's Hospital from 1904 to 1927, 71 per cent occurred within the first year. Fifteen patients were less than four months old. Thirteen of these died.[8]

In the literature there are few reports of infants under twelve weeks of age successfully withstanding surgical intervention. Collinson,[9] in 1907, reported a successful enterectomy in a twelve weeks old infant, who was operated seventeen hours after the onset. A remarkable case was recorded by Dowd[10] in 1913, when he successfully resected one-third of the colon including the transverse and part of the descending colon, in an infant five days old who had an irreducible acute intussusception. Operation was performed thirty-seven hours after the onset. Dowd stated that in 1913 only 7 cases of successful resections had been recorded in infants under one year. Four years later Steele[11] operated upon an infant four days old and easily reduced a massive invagination, but the child died the following day. Postmortem examination disclosed free blood and numerous clots in the peritoneal cavity but no evidence of peritonitis or recurrence of the intussusception. In 1919 Flint[12] successfully performed a resection for an acute invagination of forty-eight hours duration. Edington's[13] patient, aged eight weeks, was operated twenty hours after onset, but succumbed within twelve hours following a difficult resection. Another successful operation was reported by Thompson,[14] who recorded the case of a twelve weeks old infant, who recovered after a very stormy postoperative course. Two of the 34 cases

* From the Mt. Sinai Hospital Chicago, Illinois.

from the Philadelphia Children's Hospital reported by Robbins[15] were under twelve weeks of age when operated. One, aged eight weeks, admitted in poor condition with the invagination of three days duration, died on the table after resection. The second infant, aged seven weeks, operated thirty-six hours after the onset, recovered. De Langre[16] recently reported a successful case in a ten weeks old infant, operated ten hours after the onset. In this patient the head of the invagination was found to be a Meckel's diverticulum with a cyst, or an enterocystome.

Because of the foregoing data, the following case is briefly appended:

B. L., male, seventy-seven days old, normally delivered, breast fed infant, was perfectly well until the morning of admission, when his mother noted rectal bleeding without apparent cause. The child became listless and cold. On admission to the hospital within two hours after the onset the rectal temperature was 103°F., the pluse 145 and the respirations 36 per minute. The infant appeared to be well nourished and well developed, but listless. At intervals he sharply flexed the thighs on the abdomen as though in pain. The head, neck, chest, and extremities showed no abnormalities on examination. The abdomen was considerably distended and moderately soft; there were no palpable masses. Rectally, a smooth, soft mass was palpable and blood was noted on the examining finger. Examination of the urine disclosed no abnormalities. Examination of the blood revealed 70 per cent hemoglobin (Sahli), 3,870,000 red cells, and 18,200 leucocytes. The differential leucocyte count was normal. The condition was recognized as an acute intussusception by the resident physician, Dr. Maurice Golden, and the child was immediately prepared for operation. A small Rehfuss tube was passed as a precautionary measure.

Under light ether anesthesia the abdomen was opened through a right paramedian incision. The stomach was enormously dilated and nearly filled the entire abdominal cavity. A mass was found occupying the left half of the abdomen, which on examination proved to be a complete ileocolic intussusception. This was reduced with considerable difficulty and the abdomen closed. The appendix was not removed. Fluids were at once administered subcutaneously and oral feedings resumed the following day. The child made an uneventful recovery and was discharged on the fourteenth postoperative day. There has been no recurrence of the invagination.

SUMMARY

A case of acute ileocolic intussusception is recorded in an infant seventy-seven days old, successfully operated upon within three hours after the onset. Study of the literature emphasizes the rarity of the lesion in the first twelve weeks of life and discloses the records of the comparatively few number of infants who successfully withstood surgical intervention.

REFERENCES

1. Hirschsprung, H. Beobachtungen uber Darm. Invagination bei Kindern. *Jabrb. f. Kinderbeilk.*, 39: 391, 1895.
2. Hess, J. H. Intussusception in infancy and childhood, with collection of 1028 cases with statistics. *Arch. Ped.*, 22: 655, 1905.
3. Clubbe, C. P. B. The Diagnosis and Treatment of Intussusception. Y. J. Pentland (London and Edinburgh), 1907.
4. Fitzwilliams, D. C. L. The pathology and etiology of intussusception from the study of 1000 cases. *Lancet*, 1: 709 (March, 7) 1908.
5. Hipsley, P. L. Résumé of 51 cases of intussusception. *M. J. Australia*, 2: 383 (Nov. 9) 1918.
6. Perrin, W. S. and Lindsay, E. C. Intussusception; a monograph based on 400 cases, *Brit. J. Surg.*, 9: 40 (July) 1921.
7. Monrad. Acute invagination of the intestine in small children. *Acta Paediat.*, 6: 31–52, 1926.
8. Close, H. G. Acute intussusception in children. *Guy's Hosp. Rep.*, 81: 436–443 (Oct.) 1931.
9. Collinson, F. W. Intussusception in an infant three months old; enterectomy and recovery. *Lancet*, 2, Oct. 19, 1907.
10. Dowd, C. N. Resection of one-third of the colon for irreducible intussusception in an infant, five days old. *Ann. Surg.*, 57: 713, 1913.
11. Steele, K. B. Intussusception in an infant four days old. *Bull. Lying-In Hosp. N. Y.*, 11: 56, 1917.
12. Flint, E. R. Case of intussusception treated by resection with recovery at the age of just under three months. *Lancet*, 196: 938, (May, 31) 1919.
13. Edington, G. H. An analysis of 36 cases of intussusception. *Brit. M. J.*, 2: 391 (Sept., 10) 1921.
14. Thompson, W. A. Acute intussusception in an infant, with resection and recovery. *Brit. M. J.*, 2: 718 (Oct. 20) 1923.
15. Robbins, F. R. Acute intussusception, with special reference to treatment by resection of bowel; 34 cases admitted to The Children's Hospital in Philadelphia. *Ann. Surg.*, 95: 830, (June) 1932.
16. De Langre, M. Intussusception caused by Meckel's diverticulum in an infant 2½ months old. *Bull. et Mem. Soc. Nat. de Chir.*, 58: 925 (June, 25) 1932.

FOREIGN BODY IN URINARY BLADDER

O. P. MAUTERER, B.S., M.D.

OLLA, LOUISIANA

MANY types of foreign bodies have been found in the urinary bladder of the male and female, most or all having been used to produce sexual excitement. From the literature at my disposal I have been unable to find where an animate foreign body has been reported though I was able to find descriptions of sixty-three different types of inanimate objects. Recently I have had such a case and because of the unusual foreign body thought it worthy of reporting.

Recently, Garshwiler et al.* gives an excellent resumé of this condition, explain why more foreign bodies are found in the female bladder than the male and outline the symptoms, complications, etc.; therefore, it is useless for me to repeat them. Garshwiler, in this article, reports the findings of "a large piece of slippery elm bark encrusted with calcareous deposit;" a pink tallow candle 3 inches in length and ¼ inch in diameter found in the bladder of a male, a hairpin in the bladder of a young girl, a stone with a piece of "juicy fruit" gum as a nucleus in a male urethra."

A female patient consulted me for frequent and burning urination and a sensation of crawling over the pubic region. She exhibited a worm about 2½ inches long, about ½ inch in diameter, tapering nearly to a point at both ends. As I had never heard nor seen such an animal expelled from the human body I questioned the patient carefully. She stated that while douching she felt the desire to void, urination was accompanied by severe pain, intense burning and she felt something pass and found the worm in the bedpan. As I did not recognize the organism I shipped it to Dr. J. Cornell at Charity Hospital, New Orleans, La., requesting that he identify it and recommend therapy. He telegraphed "Air breathing gastropod—a variety of snail—could not be internal—entrance from outside—no therapy." On receiving this information I again questioned the patient and told her that it was probably in the bed pan before she used it. She requested an explanation for the severe pain and burning and emphatically denied that it could have been in the bedpan. Several days later she complained still of a crawling sensation in the suprapubic region. She was cystoscoped and another snail without its shell was found in the bladder. This snail was the same type as the first and was dead on removal. I diplomatically hinted that they may have been passed into the urethra by her or someone else. She denied this in a "from the tone of voice" that made me decide it best to discontinue the subject.

This is the first case, I believe, in which a snail was found in the urinary bladder.

I do not believe that this patient felt any crawling sensation suprapubically but that she knew two snails had been inserted into the bladder and only one removed. Therefore, she was worried about the other and desired its removal. It may be of interest to remark that this woman is an epileptic.

* Garshwiler et al. *Am. Jour. Surg.*, 22: 199–203, 1935.

FRACTURE DISLOCATION OF SACROILIAC JOINT

REDUCED BY WELL LEG TRACTION METHOD

WALTER G. STERN, M.D., F.A.C.S.

CLEVELAND, OHIO

E. S. white male, age twenty-seven, was brought to Mount Sinai Hospital Cleveland, Ohio, on the evening of November 1, 1934, evidently having been struck by an automobile while under the influence of liquor. He was found lying semiconscious at the edge of a driveway and was apparently so well "ethylized" that he could not walk or talk coherently.

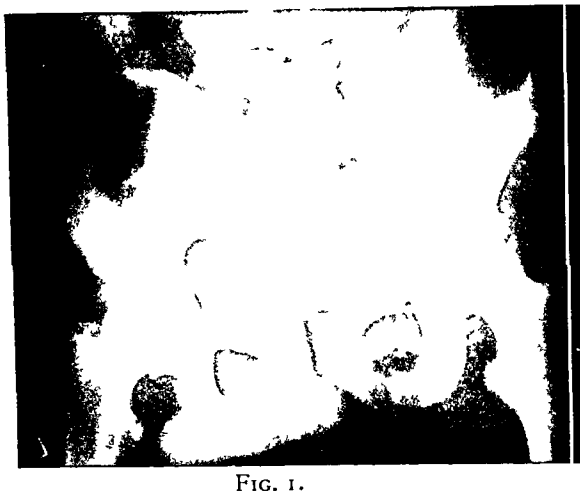


FIG. 1.

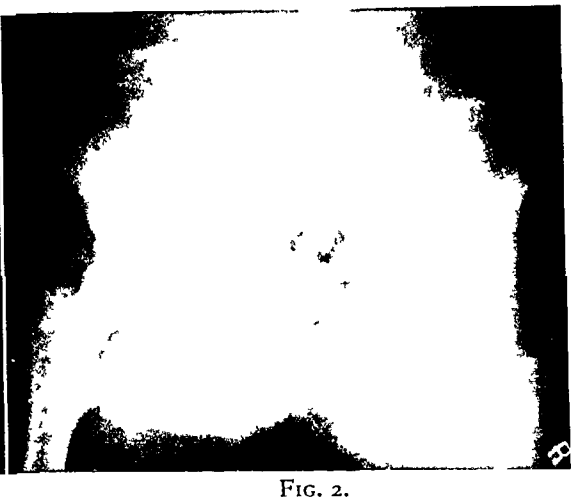


FIG. 2.

While he displayed bruises about his pelvis, he gave no expressions of pain when this was being palpated, he was sent to the Police Station as a simple alcoholic. The turnkey that night noticed that the man's condition was serious and he was immediately transferred to Mount Sinai Hospital in profound surgical shock, still incoherent and still apparently anesthesized by his intoxication. He responded to intravenous injections of gum acacia solution combined with the usual measures against shock.

The next morning was more or less conscious and coherent, and not complaining of any spontaneous pain although the buttocks presented a widespread bloody discoloration. There was no interference in the conductivity of the nerves of the lumbar or sacral plexus although the patient could not coordinate. Pressure on the iliac crests were not painful. The right leg was shorter and the trochanter higher than the left; although the hip joint seemed normal, fracture of the neck of the femur could not be ruled out entirely.

X-ray film revealed fractures through the right sacroiliac joint with a 2½ inch upward displacement of that side of the pelvis; fractures through the horizontal and descending rami of the right side of the pelvis and the transverse and descending rami of the left side with some upward dislocation or twisting of the fragments. (Fig. 1.)

Under the anesthetizing influence of the alcohol, plus focal anesthetic at the point of insertion, a Steinman pin was drilled through the lower end of the right femur and firmly attached to a plaster cast extending from the foot to the groin by means of perforated aluminum strips. Another cast was put on the left leg and foot and a well leg traction apparatus attached to both casts and maximum traction, extension and abduction were applied to this limb as could be obtained from the apparatus.

X-ray pictures ten days later showed practically complete reduction of the upward dislocation of the right pelvis at the sacroiliac joint and a probable reduction of the fractures of the left pelvis at the hip joint, (Fig. 2), and abduction of the hip obtained on the right side by such extension.

[*Concluded on p. 185.*]

NEW INSTRUMENTS

PORTABLE FRACTURE REDUCTION APPARATUS

COMBINING RECENT IMPROVEMENTS WITH BOEHLER'S PRINCIPLES

JOHN T. BATE, M.D.

LOUISVILLE, KY.

HAVING observed the fracture and traumatic work of Lorenz Boehler[1] in Vienna in 1928, it has been interesting to watch the development of various types of traction apparatus which owe their inception to the stimulus emmanating from the Boehler traction frames.

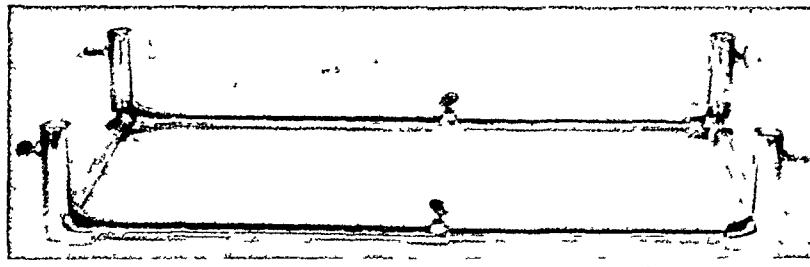


FIG. 1. Shows the base which can be lengthened and shortened, and upon which the rest of instrument can be set. Although this is of steel, it could be made of aluminum alloy.

Believing that the simplicity and adaptability of Boehler's frames have many advantages, the apparatus described represents an effort to combine the good points of later developments with those of Boehler's instruments. These are:

1. Tractors and counter tractors which allow controlled movement in all planes rather than only longitudinal skeletal traction and counter traction of the original Boehler frames.

2. The traction is directly in the long axis of the broken bone. Many of the instruments now popular have tractors which are perpendicular to the axis of the broken bone. Thus when longitudinal traction is exerted, the tractors tilt and are not efficient nor stabile.

3. It is possible to use one base and set of tractors to set up a frame for various types of traction, i.e. combining several instruments in one.

It is arranged especially for use in local and regional anesthesia, the Kirchner wire in skeletal traction, counter traction and incorporation of the wires in the non-padded plaster cast where desired. Figure 13 shows one variation of the Boehler frame as made by a manufacturer in this country.

The illustrations with explanatory notes show these features better than words. The type of traction used must be adapted to the case, many fractures being reducible by simple non-skeletal traction.

The advantages are that the surgeon has at his disposal a complete portable fracture traction table which can be easily transported, can be placed on a fluoroscopic table, can be completely sterilized in the autoclave and used at open operations and is inexpensive when compared to the cost of the large tables. It should be particularly useful in portable emergency hospital and army work. It is adaptable to

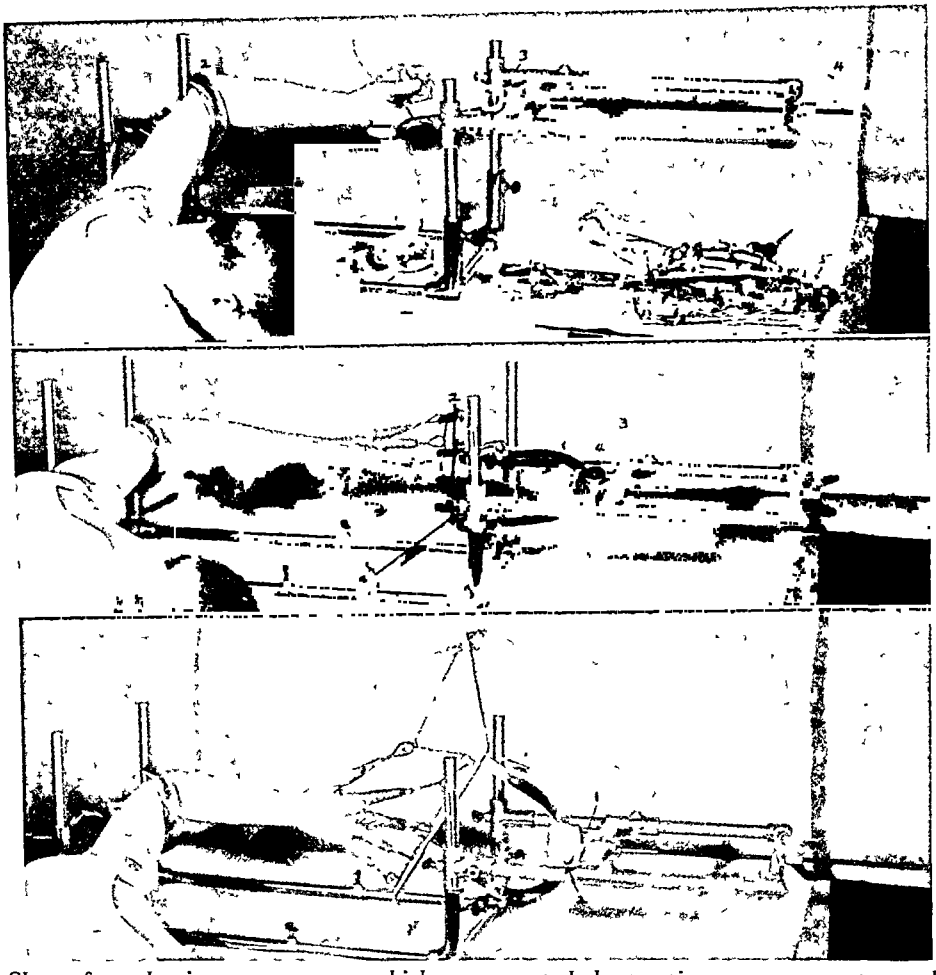


FIG. 2.

FIG. 3

FIG. 4.

FIG. 2. Shows four aluminum posts upon which are mounted the traction screw apparatus and a crosspiece (1) to which is attached by a cone-clutch the aluminum hook (2) which holds the arm. This allows rotation of the hook if necessary. The cloth around the wrist is attached to the traction screw by means of a removable aluminum ring and cone-clutch (3). Traction is obtained by screw (4). (5) Shows male portion of cone-clutch with nut, which, when tightened by means of the key which fits into the holes in its side, holds the tractor firmly at the degree of rotation desired.

FIG. 3. (1) Tractor attached to the traction apparatus by means of a cone-clutch; (2) key used to tighten the cone clutch; (3) metal bar with finger traps attached to tractor; (4) screw which turns gear.

FIG. 4. Showing how cone-clutch (1) allows supination and how gear allows radial or ulnar deviation; (2) set-screw which prevents gear turning during traction. A different arrangement of the pulleys would be necessary to obtain best effect from radial or ulnar flexion.

FIG. 5.

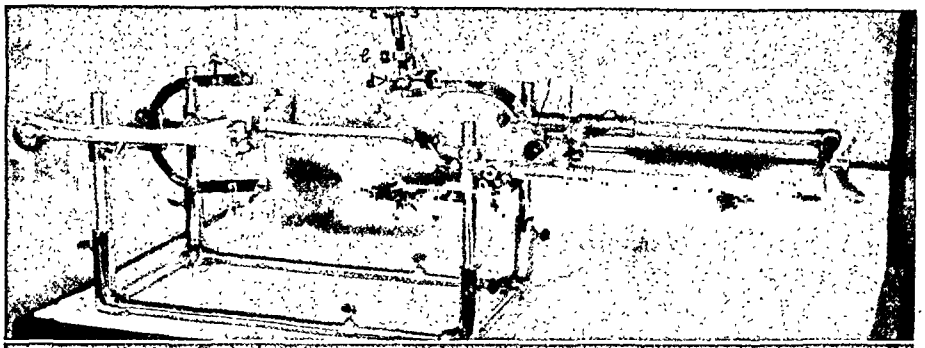


FIG. 6.

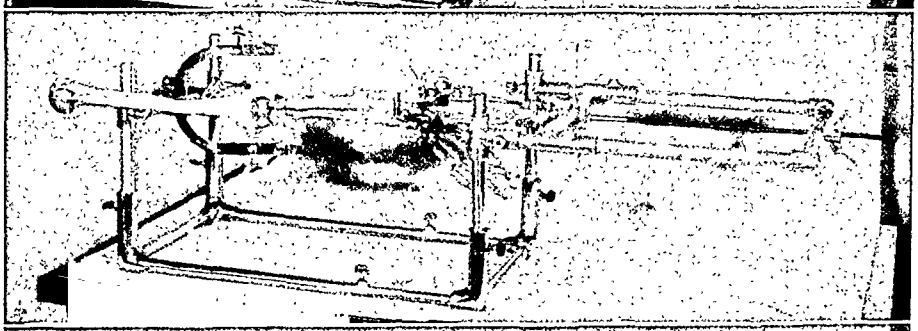


FIG. 7.

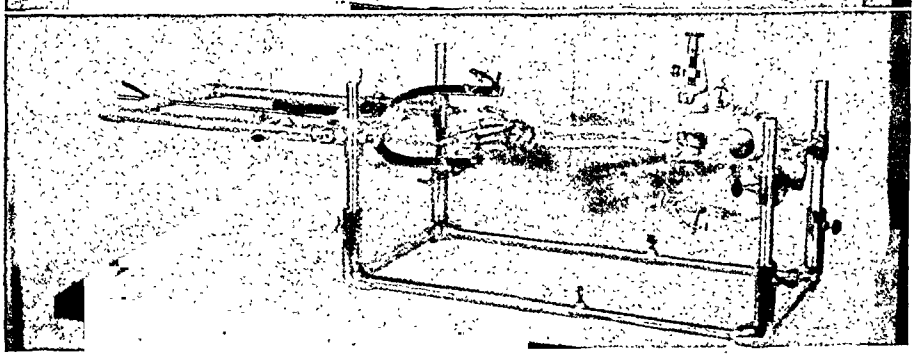


FIG. 5. (1) Tractor with cone-clutch and gear attachments; (2) the Kirschner wire is through the olecranon. If desired, this tractor or any Kirschner wire, or Steinmann pin tractor can simply be hooked over the cross piece instead of being attached by the cone-clutch. To attach this tractor as shown, the cross-piece has been reversed. (3) The metal bar and finger traps have been removed from tractor. The Kirschner wire is directed obliquely through the radius to avoid radial artery. (I have not used it thus, but plan to do so in a suitable case.) (4) The "tautner" has a flange which slips over the side of the tractor and is thus locked in place. The wire is attached by the "snubber" (a) and to the "tautner" by the "come along" (b). The thumb-screw (c) now causes the "come along" to move peripherally thus tightening the wire to any desired tension. The "snubber" (d) is then used to hold the wire taut, and the tautner removed.

FIG. 6. Shows the forearm supinated, (1) key used to tighten cone-clutch thereby preventing further rotation of tractor.

FIG. 7. Shows Kirschner wire through the metacarpals. This is useful in reduction of dislocated carpal bones. (1) Nut which prevents snubber from slipping if accidentally struck.

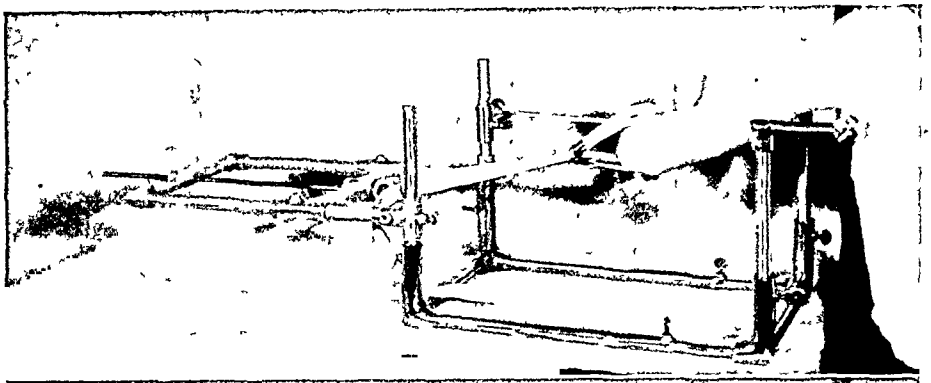


FIG. 8.

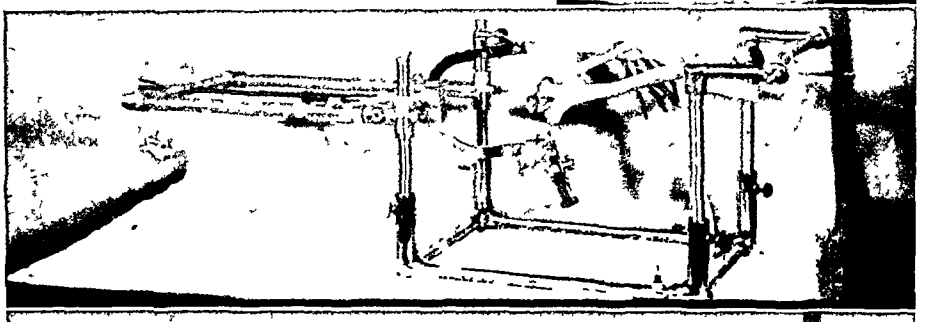


FIG. 9.

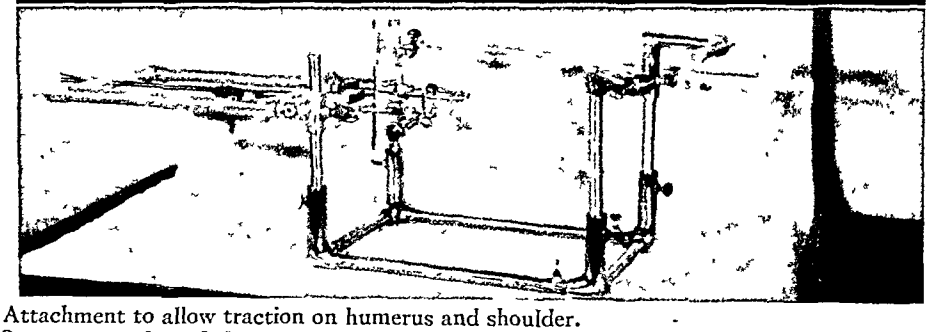


FIG. 10.

FIG. 8. Attachment to allow traction on humerus and shoulder.

FIG. 9. Same arranged for skeletal traction with wire through olecranon. The hand rests on an adjustable aluminum strip which stretches between the two far posts. This could be used with patient in recumbent position. This position is for reduction and application of plaster.

FIG. 10. Shows how the curved metal piece (a) can be freed from attachments on each side. If it should be incorporated in a cast it can be slipped out after the plaster has hardened. The foot rest (1) is placed here, merely to show how it fits on tractor.

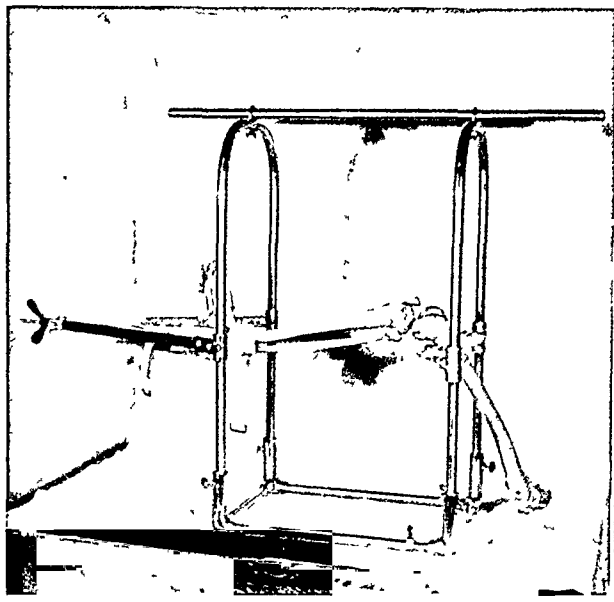


FIG. 11.

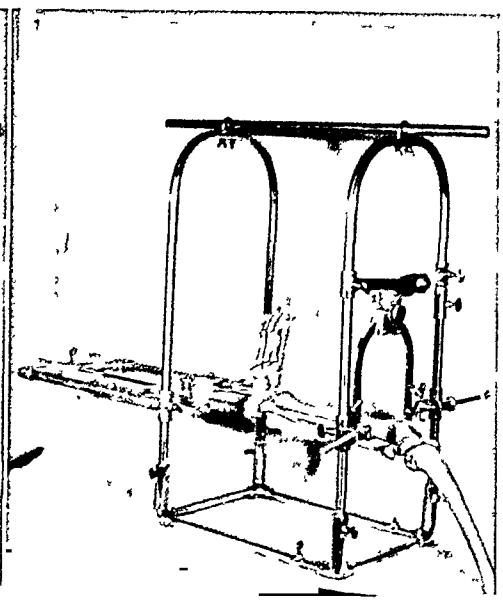


FIG. 12.

FIG. 11. The original Boehler principle of traction on lower leg with countertraction bar under knee, the cast being applied immediately and leg put on Braun frame. (Shown as made by an American company.)

FIG. 12. Arranged for skeletal traction with wires through tibial tubercle and os calcis. (1) An adaptor is attached by means of a cone-clutch to the cross piece previously shown. The tractor is attached by its cone-clutch to the adaptor. The universal joints on the screws (a) and (b) are fitted into the holes in tractor previously used to attach the finger traps. This makes the tractor rigid. In case it is desired to leave the patient in this position until maximum swelling has occurred, the leg can be suspended to prevent edema, by cloth strips from the longitudinal bar.

One wire is shown through the os calcis. It could be used to better advantage in most cases, through the lower end of tibia.

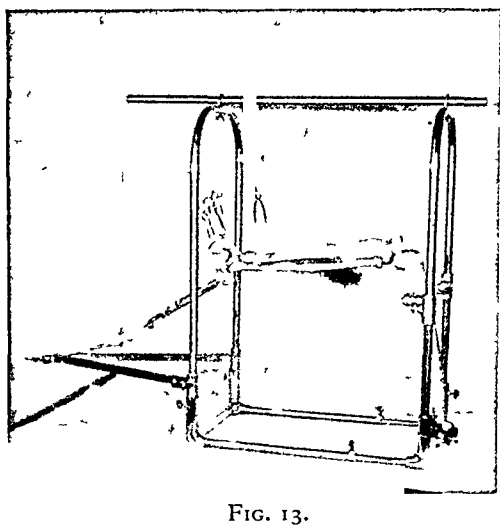


FIG. 13.

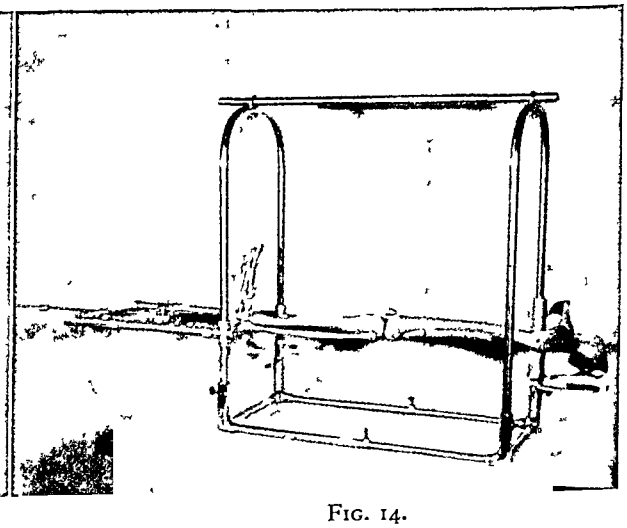


FIG. 14.

FIG. 13. In reduction of fracture of the os calcis, the pin should pass through the tibia and another through the os calcis; or ice tongs can be used on the latter. (Frame shown as made by an American company under Boehler's name.)

FIG. 14. Traction on whole leg or femur. The attachment for traction on the opposite leg is not shown. Boehler uses a somewhat similar arrangement and traction on both legs while inserting guide wires in neck of femur for use in the Johannson modification of the Smith-Petersen nail operation.

The clove hitch or similar method can be substituted for skeletal traction through tibia. The wire would usually be inserted through the lower end of tibia instead of os calcis as shown. (1) The pelvic rest simply slips over the upright (2).

In placing Kirschner wires in neck of femur as guides for the Smith-Petersen nail or bone graft, it is advantageous to have two x-ray units. This frame can be placed on x-ray table. A shock-proof portable can be used for the second unit.

inclusion of special ideas of individual surgeons.

The cone-clutch principle and the Caldwell finger traps[2] have been very helpful in designing this instrument.

The whole instrument is packed in a canvas roll which can be carried by one man. By making more of the parts of light alloys, the weight can be further reduced.

By placing the frame on end, it can be used for traction on the foot.

I am indebted to Wm. Watts for skilful machine work.

REFERENCES

1. Boehler, Lorenz. Treatment of Fractures. Vienna, Wilhelm Maudrich, 1929.
Boehler, Lorenz. Treatment of Fractures, 4th English Edition. Groves, Wm. Wood, 1935.
2. Griswold, A. *Surg. Gynec. Obst.* 58: 900–902 (May) 1934.
Anderson, R., *Surg. Gynec. Obst.* 58: 639–646 (March) 1934.

CONCLUSION OF DR. ROSENBERG'S ARTICLE*

SUMMARY

Myxosarcoma of the prostate is of rare occurrence. The clinical diagnosis is frequently difficult due to the fact that most of these patients are seen late in the disease. Pelvic tumors of mesothelial origin may arise in the retrovesical tissue and bladder and the prostate become so completely invaded as to make the diagnosis of the primary site of the tumor impossible.

A case of myxosarcoma of the prostate in a white male age forty-six years, is reported. The patient was observed early in the disease when the pathological process was limited entirely to the prostate gland.

*Continued from p. 171.

REFERENCES OF DRS. POER, DAVISON AND BISHOP*

1. Hashimoto, H. Zur Kenntnis der Lymphomatosen Veranderungen der Schilddruse (Struma Lymphomotosa), *Arch. f. klin. Chir.*, 97: 219–248, 1912.
2. Riedel. Die chronische, zur Bildung eisenharter Tumoren fuhrende Entzundung der Schilddruse, *Verhand. d. deutsch. Gesellsch. f. chir.*, 25: 101, 1896; and Vorstellung eines Kranken mit chronischer Strumitis, *Verhand. d. deutsch. Gesellsch. f. Chir.*, 26: 127, 1897; and Ueber Verlauf und Ausgang der Strumitis chronica, *Munchen med. Wchschr.*, 57: 1946, 1910.
3. Ewing, J. Neoplastic Diseases, ed. 3, Philadelphia, W. B. Saunders Co. 1928, p. 961.
4. Williamson, G., Scott, G., and Pearse, I. H. The pathological classification of goiter, *J. Path. and Bact.*, 28: 361, 1925.
5. McCarrison, R. Note on the experimental production of lymphadenoid goiter in rats, *Brit. M. J.*, 1: 5, 1929.
6. Joll, Cecil A. Diseases of the Thyroid Gland, St. Louis, C. V. Mosby Co. 1932, p. 112.
7. Graham, A., and McCullagh, E. P. Atrophy and fibrosis associated with lymphoid tissue in the thyroid: struma lymphomotosa (Hashimoto), *Arch. Surg.*, 22: 548 (April) 1931.
8. Graham, A. Riedel's struma in contrast to struma lymphomotosa (Hashimoto), *West J. Surg.*, 39: 681 (Sept.) 1931.
9. Foot, N. C. Personal communication, 1935.
10. Eisen, D. Riedel's struma with report of seven cases, *Canad. Med. Assoc. J.*, 31: 144, 1934, and The relationship between Riedel's struma and struma lymphomotosa (Hashimoto), *Canad. Med. Assoc. J.*, 31: 147, 1934.
11. Polowe, D. Struma lymphomotosa (Hashimoto) associated with hyperthyroidism, *Arch. Surg.*, 29: 768 (Nov.) 1934.
12. Howard, L. L. Struma lymphomotosa (Hashimoto), *Amer. J. Surg.*, 23: 565 (Mar.) 1934.
13. Hertzler, A. E. Diseases of the Thyroid Gland, (ed. 3). St. Louis, C. V. Mosby Co., 1935, p. 254.

*Continued from p. 175.

CONCLUSION OF DR. STERN'S ARTICLE*

The patient had an uninterrupted recovery. When demonstrated in March, 1935, before the Mt. Sinai Medical Society he was walking unassisted without cane or crutch and did not complain of any of the usual painful symptoms described as due to lesions of the sacroiliac joint.

CONCLUSION

This case demonstrates the amount of pull-push upon the pelvis that can be exerted by the well leg traction apparatus, and secondly, that genuine lesions through the sacroiliac joint are not always followed by so called "sacroiliac symptoms."

*Continued from p. 179.

SUSPENSION FOR LEG CASTS

VOIGT MOONEY, M.D. F.A.C.S.

PITTSBURGH, PENNSYLVANIA

THE application of a plaster-of-Paris leg cast for various affections of the knee joint brings up the question, "Will the cast stay in place and not slip down about the ankle when the patient is walking?"

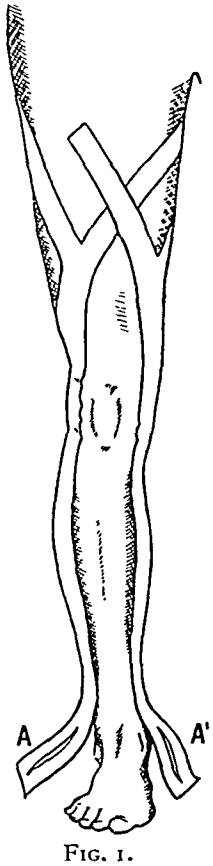


FIG. 1.

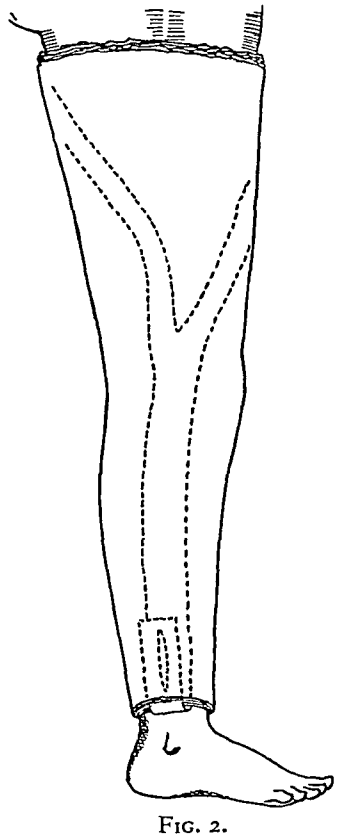


FIG. 2.

If the knee is flexed and the leg has a large calf and the cast is properly applied it will not slip. In obese individuals when the thigh and leg form a modified cone, some means of suspension is required to prevent the cast from slipping down about the ankle.

For several years I have successfully used the following method at the Allegheny General Hospital, Pittsburgh.

1. Adhesive (zinc oxide or mole skin) is applied to the affected leg as Fig. 1. Note the slits in the double thickness AA'.

2. Cotton sheet wadding about the leg and thigh is applied over the adhesive.

3. After the application of several layers of plaster-of-Paris bandage, the flaps A and A' are directed proximally and the plaster-of-Paris bandages are passed through the slits. The flaps A and A' are incorporated in the cast, Fig. 2.

Thus the cast is prevented from descending by a J-shaped piece of adhesive, the longer end being attached to the skin of the leg and the shorter end incorporated in the cast.

PROCTOSCOPE ADAPTER FOR OTOSCOPE BATTERY HANDLES*

WILLIAM LIEBERMAN, M.D.

BROOKLYN

THE instrument here described is intended to facilitate and encourage more frequent diagnostic rectal examinations under direct vision. This is done by a simple means of attaching proctoscopes and sigmoidoscopes to a battery handle such as is commonly used for otoscope and ophthalmoscope. The adapter which the writer devised for this purpose also eliminates the need for the wire connections, the transformer and the current outlet necessary when house current is used for illumination. It thus lends itself to convenient use in the patient's home.

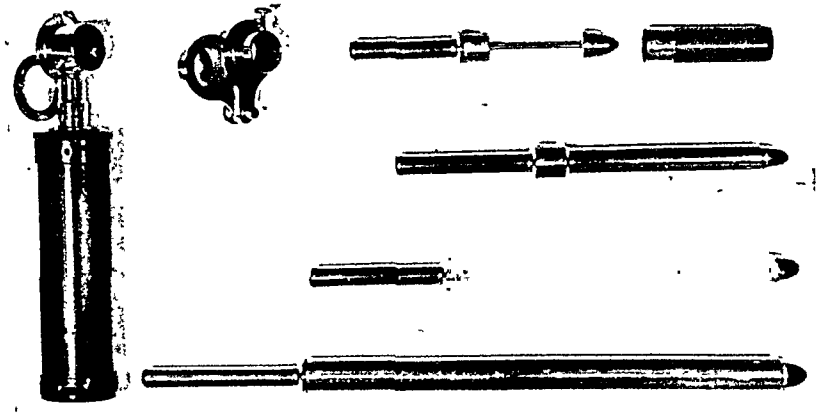


FIG. 1. Battery handle, adapter and various sizes of scopes.

The adapter (Fig. 1) consists of two collars joined at a pivot upon which they can be separated or swung into alignment. One collar fits into the light-bearing otoscope head, while into the other collar fit anoscopes, proctoscopes or sigmoidoscopes of various lengths and diameters both for adults and for infants.

The battery handle (Fig. 2) is grasped by the operator's hand and pressure applied on the obturator by the thumb of the same hand and the proctoscope is inserted into the rectum. The obturator is then withdrawn and the light-bearer is swung into place on the pivot to illuminate the interior of the rectum. The inside of the sigmoidoscope is gunmetaled to prevent back glare. The light is pivoted aside to permit the re-introduction of the obturator or the use of cotton tipped applicators for swabbing the mucosa without soiling or damaging the electric light bulb. All parts in contact with the patient, including the adapter, are sterilizable by boiling. With the window adjusted the rectum can be distended with air, if desired.

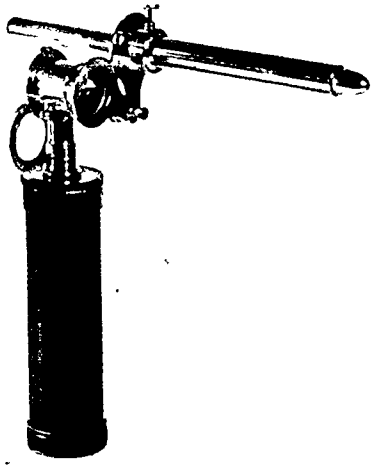


FIG. 2. Instrument ready for insertion into rectum.

SUMMARY

A simple adapter has been devised for attaching proctoscopes on an otoscope battery handle, thus facilitating rectal and sigmoid examinations with a minimum of manipulation and eliminating the need for wire connections and a transformer.

* From the Rectal Clinics, The Beth Moses Hospital, and The Jewish Hospital of Brooklyn.



[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

SPECULUM MATRICIS BY JAMES WOLVERIDGE

ONE OF THE RAREST BOOKS ON MIDWIFERY*

EDGAR F. KISER, M.D., F.A.C.P.

Associate Professor of Medicine and Lecturer in Medical History, Indiana University School of Medicine

INDIANAPOLIS, INDIANA

MANY a delightful volume has been written with the amenities of book collecting as its central theme. However, the author of that euphonious phrase, "The Amenities of Book-Collecting," rather derides the particular phase of the hobby which is most interesting to all of us. Newton in his essay "Old Catalogues and New Prices" says, "Some catalogues annoy me exceedingly: those which contain long lists of books that are not books; genealogies; county histories, obsolete medical and scientific books; books on agriculture and diseases of the horse." Be that as it may, to many of us the collection of such books is our chief delight, our golf and bridge rolled into one, a surcease from the daily grind, a diversion filled with many sore disappointments but with an occasional happy surprise.

The wealthy collector with an agent in every important center can fill his shelves as his fancy dictates, but to the amateur bibliophile no experience brings with it quite such a thrill as does the chance acquisition of a rare volume. Such an experience was mine about two years ago. An American nurse, long a resident in the Philippines, found in an old library a small volume on midwifery, to which she was attracted by its unusual frontispiece and by the quaintness of its text. She was about to return to the United States and, with no particular purpose in mind, put the book in her trunk. Learning of my interest in old medical works she presented it to me, with no notion of its origin or its rarity. Its very name was hitherto unknown to me and I never had heard of its author.

The book is titled, "Speculum Matricis, or the Expert Midwives Handmaid," written in 1669 by one James Wolveridge of Cork, Ireland and published in London in 1671. I found no mention of the book in any available reference works and appealed for aid to Dr. Alfred M. Hellman of New York. He also failed to find a reference and turned to Dr. Archibald Malloch for information. Through Dr. Malloch we learned of a somewhat extended discussion of the volume by Herbert R. Spencer, in the proceedings of the Royal

* Read before the Eleventh Annual Meeting of the American Association of The History of Medicine, Atlantic City, N. J., May 6, 1935.

Society of Medicine for May, 1927. Spencer calls "Speculum Matricis" one of the rarest books on midwifery, but Aveling has erroneously described it as the "Earliest original work on midwifery in the English language." There are, according to Spencer and Professor E. Essen-Möller of Lund, Sweden, only three known copies other than mine, one in the Royal College of Physicians of Edinburgh, one in the Radford Library, now the library of the Medical School of Manchester, and the third is possessed by the Royal College of Surgeons of London. The Edinburgh copy is in perfect state; that in the College of Surgeons has pages 144 and 145, and pages 159 to 166, in manuscript; the Manchester copy lacks the frontispiece. A magnificent manuscript copy, the work of Dr. John Lee Jardine, is in the Library of the Obstetrical Society of London. There is also an Irish edition of the book entitled, "Speculum Matricis Hybernicum, or the Irish Midwives Handmaid," and of this edition there are only two known copies, one in the Bodleian and one in the private library of Professor Essen-Möller.[1] The Irish book is identical with the English edition with the exception of changes on the title page.

My copy of this book is perfect as to text and plates except for a small portion torn from the lower edge of one plate. It is in contemporary calf, somewhat rubbed, and its size is 5¾ by 3⅞ inches. A few pages have been closely shaved. It contains twenty-three pages of introduction, twenty pages of index, eight pages of preface, and one hundred sixty-six pages of text. The book has a most unusual two-compartment frontispiece, and the text contains eight plates and twenty-one illustrations.

The introduction consists of a chapter entitled "The Author to the Reader." This is in a somewhat apologetic vein, asking the indulgence of the reader for the context and for the fact that the book is written in the vernacular rather than in Latin, but expressing the hope that the work "will be candidly received by all." This introductory paragraph is followed by a number of encomiums contributed by various friends of the author, some written in English and some in Latin verse, and concluding with an "achrostick" incorporating the author's full name.

The quaint text is, as the author says on his title page, "catechistically composed," and consists of a series of dialogues between one Dr. Philadelphos and a Mrs. Eutrapelia, the midwife. The questions and answers constitute the manner of instruction in obstetric practice. The book contains little that is original, and is made up largely of deliberate plagiarism from "The Expert Midwife," which was merely an English translation in 1637 of Rueff's "De Generatione Hominum" of 1580. The illustrations are from Rueff, who in turn had lifted them bodily from Rosslin's "Rosengarten" published in 1513. Spencer comments on this wholesale literary theft and quotes Thomas Fuller who, in 1662, wrote, "Such plagiary-ship ill becometh authors and printers; and the dove bearing the Crest of the Stationer's Armes should mind them not, like rooks, to filch copies from one another." It seems, however, that Fuller's words fell on deaf ears, as plagarism, thinly veiled, was exceedingly common then as now.

Little is known of the author, James Wolveridge, beyond the fact that he was an Englishman practicing in Ireland, the preface of the book being inscribed "From my study in Cork, Jan. 13, 1669." Herbert Spencer quotes Sir Charles Cameron who, in his history of the Royal College of Surgeons of Ireland, says of Wolveridge: "His name appears but with a question mark before it in Belcher's History of the Fraternity of Physicians, Trinity Hall, Dublin, established in 1660. I find the name James Wolveridge, M.D., 1664, in Dr. Todd's Roll of Graduates of the University of Dublin." The only references that I have been able to find to Wolveridge are the mere mention of his name and book in Watts' Bibliotheca Britannica and Haller's

[1] Irish Journal of Medical Science, sixth series, No. 78, June, 1932.

Bibliotheca Medicinae Practica, and his Bibliotheca Chirurgica. Neither the Army Medical Library nor the Library of the New York Academy of Medicine could give me further information.

The frontispiece of the "Speculum Matricis" is of unusual interest. It is divided horizontally into an upper and lower compartment. The upper contains a picture of the lying-in chamber, wherein the mother is in a canopied bed and the nurse, holding the babe swathed after the manner of the time, is seated before an open grate fire. The lower compartment represents the physician in powdered wig and velvet hat, addressing the pregnant woman and the midwife who holds a small book in her right hand and watches intently as the doctor addresses his patient. The woodcut is the work of Cross and according to Herbert Spencer, the identical picture also adorns the frontispiece of an anonymous work entitled "The English Midwife, Enlarged," published in London in 1682 by Rowland Reynolds, who was also the publisher of Wolveridge's work. My copy of Nicholas Culpepper's Pharmacopeia Londonensis, 1653, contains a portrait of Culpepper by the same artist, and this portrait so closely resembles that in Culpepper's Directory for Midwives, 1651, that I have no doubt it was the work of the same man, even though it is unsigned.

Not the least interesting detail of the book is a chronogram on the title page. A chronogram is defined by James Hilton, who has written an entire volume on the subject, as a "sentence or verse, wherein certain letters express a date, while the sentence itself is descriptive of or allusive to the event to which the date belongs."

The date itself is expressed by Roman numerals, these letters being distinguished from the others by being printed or carved in a larger size, so that they stand out as capital letters in the middle of a word. It is also necessary, in order that the chronogram be a perfect one, that every letter in the sentence which has a numerical equivalent must be employed. Chronograms are not common in secular literature, but are frequently found in religious works, especially those of the Catholic church. The Bibliotheca Osleriana contains the names of two medical works which are dated by the use of chronograms.

The chronogram on the title page of "Speculum Matricis" is as follows: "IVXta MagnaLIa DeI sCrIptor (Juxta Magnalia Dei Scriptor)" which, loosely translated, is "Written by the Grace of God." It conforms to the rule for producing a perfect chronogram, which is to say that it employs all of the letters which have equivalents in Roman numerals. They total 1669, the year in which the book was written. Its inclusion was, no doubt, just a whim on the part of the author.

There is little about my "rara avis" to distinguish it from many another old medical treatise that was lost in limbo, because it had no particular educational or scientific value. Why, then, this presentation? Because there is connected with the book what the modern news hawk calls a human interest story, and I believe that it can best be told by quoting verbatim and at some length from the British Medical literature of half a century ago. The British Medical Journal for February 23, 1884, carried the following paragraph, under the heading, "A Lost Medical Work."

At the annual meeting of the Obstetrical Society of London, Dr. Aveling mentioned that the Society had some time since asked Dr. Fordyce Barker of New York, to have made for them a transcript of Wolveridge's "Speculum Matricis." This book, published in Dublin in 1670, is the earliest original work on midwifery in the English language, and the only copy known to exist was in the possession of Dr. Fordyce Barker who, at the request of the Society, employed a man to copy it. This person absconded with the volume, and died in Europe. Thus, it is feared, the only copy of this work has been irretrievably lost. It is asked that if any of our readers should meet with or hear of a copy of this rare book, they will inform the Honorary Librarian of the Obstetrical Society of London.

A week later, March 1, 1884, the same journal contained the following interesting article:

In reference to the loss of Wolveridge's Speculum Matricis, published in Dublin in 1670, and the earliest original work on midwifery written in the English language, we have learnt, since our article on the subject last week, the following particulars from Dr. Godson, who informs us that the person intrusted with the volume, for the purpose of copying it, has not been proved to have absconded with the volume. Dr. Fordyce Barker, in a letter to Dr. Godson, dated May 15, 1883, gives a full account of the transaction. Dr. Barker possessed a copy of the book in question, and about five years ago, at the request of the Obstetrical Society of London, took steps to find a man who could make a copy of it for the Society. Two American librarians referred Dr. Barker to a well-known and learned dealer in old books, named Sabine, now deceased. Mr. Sabine recommended an eccentric Frenchman, who lived in constant penury, but was a good copyist, much employed by collectors in New York, London, Paris, and Rome. This man, whose name was Emile Bouregeaud, undertook to copy the specimen of Speculum Matricis, which was at once lent to him for the purpose by Dr. Barker, who could not get him to fix on any sum to be paid for his services. Dr. Barker lost sight of Bourgeaud for a long time, but in April, 1881, he brought back the book, repaired with great skill, but only a part of the copy. Starvation had evidently prevented him from completing his task. Dr. Barker has never seen since then this poor copyist, who took away the book once more to complete the copy. He wrote once to Dr. Barker, saying that he had been invited to Brazil by the Emperor, in order to do some work for the Imperial Library, but hoped to be back in New York by November, 1881, with the book completely copied. Bourgeaud never returned the work. Dr. Barker communicated with the United States Legation at Rio de Janeiro, and was informed that Bourgeaud had really been at work in the Imperial Library, and he had never asked for any remuneration, though his work had given great satisfaction. A steerage-passenger in a steamer which sailed from Rio in November, 1881, was entered in the ship's list as "A. Boojo." Dr. Barker then discovered that the ship's cook, a Frenchman, named Quinquinet, had taken great interest in this passenger. On landing in New York, he took his unhappy countryman, who was in very bad health, to a low French tavern in Worcester Street. In May, 1883, Dr. Barker found out this tavern, and discovered from the landlady that the sick Frenchman had brought with him a box, and asked for ink, but used to sit still in his room doing nothing, and his reckoning was only once paid, and then by some friend, who took him and his trunk away. This is the last news that Dr. Barker could obtain about poor Emile Bourgeaud. It is very unlikely that he destroyed either the original book or his copy, and it is to be hoped that it was found in the box by the friend, if Bourgeaud really died soon after leaving the French tavern, as appeared to be highly probable. If the friend and the box could be traced, the ultimate fate of the book may yet be known. Possibly some of our readers may find the missing work on this or on the other side of the Atlantic.

Interest in the book did not abate. As late as November 17, 1888, the following note from James Blake Bailey appeared in the *Athenaeum*, under the heading "Wolveridge's 'Speculum Matricis:'"

I venture to send this note to the Athenaeum in the hope that it may elicit some information concerning the very scarce book above mentioned. The book in question is the first original work on midwifery in English. Dr. Fordyce Barker, of New York, had a copy which was supposed to be unique, and this he gave into the hands of the copyist so that a MS. copy might be made for the Obstetrical Society of London. The man, a Frenchman, named Bourgeaud, did not return the book, and probably did not finish the copy. After an interval of nearly five years Dr. Fordyce Barker traced Bourgeaud to a tavern in New York, and on inquiry found that he had died there and that his box had been removed by a friend. Since then nothing has been heard of this copy of the "Speculum." A note in the British Medical Journal drawing attention to this loss brought out the information that there were two other copies in existence, one in the Radford Library at St. Mary's Hospital, Manchester, and another the property of Mr. J. L. Jardine. This latter book, which has some of the pages supplied in MS. from the Man-

chester copy, was presented to the library of the Royal College of Surgeons by Mr. Jardine. The title of the book is "Speculum Matricis; or the Expert Midwives Handmaid. Catechistically composed, by James Wolveridge, M.D., with a copious alphabetical index, London, 1671.

On looking through the copy in the College of Surgeons' Library I was much puzzled by the following statement in the "Author to the Reader," as I could not find anything on the title-page to correspond with the "Irish Garb" to which the author refers:

'Though the Title-Page may arrive your view in an Irish Garb, with her Handmaid bare-foot, and bare-legg'd; or at the best, in Brogues and Kerchers, (according to the Custome of the Countrey), yet, be assured It hath an English dress under an Irish mantle; it being never intended for the Irish, (though I heartily wish it may be serviceable to them also, if occasion be,) whose fruitfulness is such, that there is scarce one barren among them. . . . '

On reference to the Bodleian catalogue I found the book entered as 'Speculum Matricis Hybernicum, or the Irish Midwives Handmaid, Lond., 1670'; and on examination of this copy it was readily seen that the book had been issued in 1670 with the title as in the Bodleian catalogue, and that in 1671 a new title had been printed, omitting all reference to "Hybernicum." So far as I can find the Bodleian copy is unique, unless Dr. Barker's copy be still in existence. This is said to have been published in Dublin in 1670, but in all probability it is the same edition as that in the Bodleian.

This, then, is the story of Speculum Matricis. What a wealth of speculation is conjured up by the tale. Is it the story of my book, or is it the story of Professor Essen-Möller's, or is there yet another copy, THE copy, resting perhaps in an unknown grave? There is nothing in the description of the lost volume to enable one to determine whether it is of the English or the Irish edition. The one mark in my copy which even remotely connects it with the eccentric French copyist is a small letter "B" which might be Bourgeaud's initial, and this is inscribed in an old hand and in faded ink upon the title page. Of course, this may be a mere coincidence, and I know of no way by which the identity could be positively established. If it be the lost work, how came it to the Philippines? Speculation is useless. The secret lies buried forever with poor old Bourgeaud.



SPECULUM
MATRICIS;
OR, THE
EXPERT MIDWIVES
HANDMAID:
Catechiſtically Compoſed,
BY
JAMES WOLVERIDGE,
M. D.
With a Copious Alphabetical Index.

WRITTEN
IVXta MagnaLIa DeI sCrIptor.,
Anno Domini, 1669. Chronogramma, 1669.

Damnoſa quid non imminuit dies?
Ætas parentum, pejor avis, tulit
Nos nequiores, mox daturos
Progeniem vitioſiorem.
Horat. Lib. 3. Carminum, Ode 6.

London, Printed by E. Oxer; and are to be ſold by

BOOK REVIEWS

THE RADIOLOGY OF BONES AND JOINTS. By James F. Brailsford, M.D., M.R.C.S. (Eng.), Hunterian Professor, Royal College of Surgeons, England, 1934–5; Radiological Demonstrator in Living Anatomy, The University of Birmingham; Honorary Radiologist to Queen's Hospital, Royal Cripples' Hospital, Warwickshire Orthopedic Hospital, and Radiologist to St. Chad's Hospital and the City of Birmingham Infant Welfare Centres, Birmingham; Awarded the Robert Jones Gold Medal and Prize of the British Orthopedic Association, 1927. Second Edition, with 340 illustrations. Baltimore, William Wood & Company, 1935. Pp. 572. Price: $9.00.

The necessity for a reprinting of this work within a year of its initial publication is striking proof of the value of its contents, constituting eloquent testimonial to the appreciation given it by the medical profession. The reprinting afforded opportunity for including in the second edition supplementary findings of many researches conducted during the past year. The chapters dealing with Bone Dystrophies and Spondylolisthesis were re-written, and a chapter has been added on Dental Radiography. Some of the less satisfactory illustrations have been replaced by new and better ones, and a number of additional illustrations have been included. The index has been greatly amplified and improved.

Much could be written in praise of this excellent treatise. Apart from setting forth concisely an account of the bone changes seen in health and disease, the author has endeavored to indicate the significance of the radiological findings and further to present briefly the recent advances already recognized by radiologists and radiologic journals but not yet adequately appreciated by general text-books. The quality of the illustrations is good in spite of the increased difficulty of satisfactorily reproducing radiographic illustrations.

One criticism appeals to the American reader: while many references to the literature have been given, the list is by no means comprehensive. It could hardly be so without greatly expanding the book, but it seems to the reviewer that among the names chosen, some of the more important are conspicuous by their omission. For example, in listing pioneers in sinus radiology, Caldwell and Law are not mentioned. However, the author does not claim to offer an exhaustive bibliography. After all, this is a minor criticism of a splendid work.

RECENT ADVANCES IN CARDIOLOGY. By Terence East, M.A., D.M., F.R.C.P. and Curtis Bain, M.C., D.M., M.R.C.P. Third edition with 14 plates and 85 text-figures. Phila., P. Blakiston's Son & Co., Inc., 1936.

The surgeon who wishes to brush up on the subject of cardiology, and, also, be brought up to date can do no better than consider this monograph of 350 pages. That it is now offered in a Third Edition speaks well of its popularity and value.

The authors inform us that in this third edition they have rewritten the entire work aiming to impart the newest information.

The theme of the book is the importance of the health and efficiency of the heart muscle. Many subjects are considered; to enumerate a few: failure of the heart and its treatment, total ablation of the thyroid gland in heart failure, coronary thrombosis, auricular fibrillation and flutter, hypertension, hyperthyroidism, and radiology of the heart and great vessels. A large number of new electrocardiograms have been included.

The index is ample. A sufficient bibliography has been appended at the end of each chapter. We recommend this work to surgeons and general practitioners.

CLINICAL MISCELLANY. The Mary Imogene Basset Hospital. Vol. 2: 1935. Springfield, Ill., Charles C. Thomas.

As the title conveys, this volume consists of twenty articles by nine men on the staff of the Mary Imogene Basset Hospital. In the last paragraph of the preface, George M. Mackenzie writes, "The contributors to this volume of correlated clinical and laboratory observations would like to believe that they

are moving, even though slowly, along the path of integration."

Some of the titles, and all of them are interesting, are: Cholelithiasis and Cholecystitis in Childhood, Four Cases of Intussusception, Carcinoma of the Vulva, Primary Carcinoma of the Fallopian Tube, Some Remarks on the Treatment of Large Decubitus Ulcers, Six Years Experience with Acute Anterior Poliomyelitis in a Rural Community, Juvenile Acrodynia, Staphylococcus Aureus Bacteriemia possibly Associated with Undulant Fever, Fatal Hemorrhage from an Eroded Vessel in a Case of Scarlet Fever, Idiopathic Aplastic Anemia, Bacteriemia. The Results of 1283 Consecutive Blood Cultures in a Rural Hospital, etc.

The articles cover a wide range. They are well written and show that they are based on careful, painstaking work.

There is an index. It makes good reading for those interested in such subjects.

Disease and Destiny. By Ralph H. Major, M.D. Illustrated Preface by Logan Glendening, M.D. D. Appleton-Century Company, 1936.

If you are interested in history and give thought to the ills of mankind that have directly changed the course of human events, as well as the destinies of nations, then for sheer entertaining, as well as instructive reading, you will do well to get a copy of Dr. Major's latest book.

The author has painted his picture in ten chapters, each complete in itself and each, to the reviewer at least, is a gem. The subjects offered us are: The Black Death, Jail Fever, The King's Evil, Small-pox, Membranous Croup, The Pestilence That Walketh in Darkness, The Disease of Lazarus, Yellow Jack, The Legacy of Bleeding, and The Worst Picture of All.

In his foreword the author says that disease has played a dominant role in the destiny of the human race, destroyed old races, defeated armies, paralyzed trade, altered the economic life of nations, wiped out old castes and created new ones, and also has profoundly affected the lives of great leaders who have left their impress on history. At times Dr. Major surprises us, but he always intrigues us with his technique of telling us things we know.

It will not take you long to read this book, for, between times it will not be out of your hands until you turn the page and note the heading . . . "INDEX."

The Early Diagnosis of the Acute Abdomen. By Zachary Cope, B.A., M.D., M.S., F.R.C.S. Seventh Edition. London, Oxford University Press, 1935.

Aware that an early diagnosis in acute conditions of the abdomen is exceptional, the author felt that there was room for a small book dealing solely with the evaluation of the various puzzling symptoms present in urgent abdominal disease. This was in 1921. Two years later a second edition appeared and went through two printings. Editions followed in 1925, 1927, 1928, and 1932. This year this short but invaluable work is offered in a seventh edition.

The author in the first chapter considers "The Principles of Diagnosis in Acute Abdominal Disease." There are chapters on "Method of Diagnosis, Appendicitis and Differential Diagnosis, Perforation of a Gastric or Duodenal Ulcer, Acute Pancreatitis, Acute Intestinal Obstruction, Intussusception, Cancer of the Large Bowel, The Early Diagnosis of Strangulated and Obstructed Hernia, Acute Abdominal Symptoms in Pregnancy and the Puerperium, Ectopic Gestation, Cholecystitis, The Colics, The Early Diagnosis of Abdominal Injuries, The Acute Abdomen in the Tropics, Acute Abdominal Disease with Genito-Urinary Symptoms, The Diagnosis of Acute Peritonitis, and Diseases which may Simulate the Acute Abdomen." There is an ample index and thirty-three illustrations.

The author says that in the seventh edition he has made several small alterations in the text and that the chief additions have been paragraphs showing the help which may sometimes be obtained from *x*-rays in the diagnosis of intestinal obstruction. It is a valuable and practical work.

Note

In reviewing Puerperal Gynecology in the December, 1935, issue, the author's name was misspelled. It should be J. L. Bubis.

The American Journal of Surgery

is the leading independent surgical Journal. It publishes many papers read before the outstanding Surgical Societies, but it is not "the official organ" of any organization. Every manuscript is selected by the editors, as worthy of publication—nothing is published because "it was read at the meeting."

NEW SERIES, VOL. XXXII MAY, 1936 No. 2

EDITORIAL BOARD

Editor

THURSTON SCOTT WELTON

New York

D. C. Balfour	Rochester, Minn.
Carl Beck	Chicago
Geo. R. Brighton	New York
M. F. Campbell	New York
James T Case	Chicago,
Isidore Cohn	New Orleans
W. B. Coley	New York
F. A. Coller	Ann Arbor
George W. Crile	Cleveland
E. C. Cutler	Boston
R. V Day	Los Angeles
Charles A. Elsberg	New York
C. R. G. Forrester	Chicago
H. Dawson Furniss	New York
J. H. Gibbon	Philadelphia
Emil Goetsch	Brooklyn
Charles A. Gordon	Brooklyn
Donald Guthrie	Sayre, Pa.
A. E. Hertzler	Kansas City
C. Gordon Heyd	New York
Louis J. Hirschman	Detroit
James M. Hitzrot	New York
F C. Holden	New York
Emile F. Holman	San Francisco
J. A. Hyams	New York
R H. Jackson	Madison
John E. Jennings	Brooklyn
W. L. Keller	Washington, D.C.
H A. Kelly	Baltimore
T. J. Kirwin	New York
Arthur Krida	New York
A. V S. Lambert	New York
H. H. M. Lyle	New York
Jerome M. Lynch	New York
Urban Maes	New Orleans
Harrison S. Martland	Newark
J Tate Mason	Seattle
R Matas	New Orleans
Roy D. McClure	Detroit
H. C. Naffziger	San Francisco
C. R. O'Crowley	Newark
Louis E. Phaneuf	Boston
Eugene H. Pool	New York
Douglas Quick	New York
N. P. Rathbun	Brooklyn
H. A. Royster	Raleigh
Henry S. Ruth,	Philadelphia
A. C. Scott	Temple
M. G. Seelig	St. Louis
J. Bentley Squier	New York
H. J Stander	New York
George W Swift	Seattle
Grant E. Ward	Baltimore
J. H. Woolsey	San Francisco

EDITORIAL

CITIZENS ONLY

ABOUT two years ago the Commissioner of Hospitals of New York City, ordered that only registered nurses who were citizens of this country, or who had their first papers, were to be employed in the municipal hospitals.

The argument advanced was that there were many nurses who were citizens, who were having a hard time making ends meet and our first duty was to our own. Nurses who were citizens of other countries, would have to rightfully step aside and give our own girls first chance.

In many quarters sharp criticism of this order found expression. At the time, we wrote the Commissioner asking if an exception could be made in the case of a nurse who for several years, had headed one of our divisions. We just felt things would "go to pot" without her in charge. But there were no exceptions to the rule and she departed. A new head nurse arrived who has been with us ever since, giving one hundred per cent satisfaction. The other nurse went home and, later, married.

Recently a leading article in the Saturday Evening Post reviewed working conditions abroad. Boiled down, we learned that in foreign countries their citizens get the jobs that are available. If an American held a position, he or she was dismissed and a citizen of that country filled the vacancy. Tough on Americans . . . but, we reflected, blood is thicker than water, and they look out for their own *first*.

Since the depression and unsettled economic and political conditions abroad, many foreign physicians, finding the going hard, resorted to the expedient of packing their grips and catching a boat for the United States. The laws regarding the medical practice act differ in the various States, and some foreigners got their license through the back door, some took State Board examinations, and not a few got sinecure teaching assignments which permitted them to practice. Many of these gentlemen remain with us about eight months

a year, skim the cream and then run back "home" for a holiday. We have permitted this condition to exist. We have welcomed these physicians but, on the other hand, their countries adopt the opposite system. As an example, have an American physician decide he will move to France and practice, and learn what he has to do before he will be permitted legally to open an office. Then compare their system with ours.

And so a bill (No. 1510), which has been introduced in the New York Assembly by Mr. Conway, is interesting. Briefly, this bill proposes that no one who is not an American citizen is to be permitted to take the New York State Board examinations for license to practice medicine. Merely indicating an intention of becoming a citizen, or having at some time taken his first papers prohibits one from applying for a license. To be eligible to take these examinations the applicant *must be a citizen.* As this is written no one knows the fate of this bill. But physicians in other States might do well to study this bill and keep an eye open for the results.

Maybe the time has come when we will cease being a dumping ground for physicians from far countries, who look upon ours as a land of honey and easy money. Maybe the time has come when some sort of a protective medical tariff is necessary.

Or, are we suffering from a form of hysteria, and wasting our apprehension on "the sweetness of the desert air"?

T. S. W.

William Bradley Coley
1862–1936

William Bradley Coley, eminent surgeon, long a member of the Editorial Board of this Journal, and a sincere friend, died April 16, 1936, at the age of seventy-four years, following an operation at the Hospital for Ruptured and Crippled, on whose staff he had served for the past forty-five years.

Doctor Coley was a delightful companion; he never grew old, nor did he lose his early enthusiasms, and his mind always looked into the future.

We of The American Journal of Surgery will miss him; American Surgery has lost one of its outstanding men.

T. S. W.

Subscribers to The American Journal of Surgery *visiting New York City are invited to make the office of the publishers (The American Journal of Surgery, Inc., 49 West 45th Street, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices.*

POSTOPERATIVE ATELECTASIS

FREDERICK CHRISTOPHER, M.D., F.A.C.S.
Associate Professor of Surgery,
Northwestern University Medical School
Chief Surgeon, Evanston (Ill.) Hospital
EVANSTON, ILL.

AND JAMES M. SHAFFER, M.D.
Miami Valley Hospital
DAYTON, OHIO

THE occurrence of several cases of atelectasis following surgical operations at the Evanston Hospital during the last few months, coupled with the apparent rarity of the condition previous to this time has prompted the following study of postoperative pulmonary complications.

Wm. Pasteur[1] in 1890 was the first to describe atelectasis, calling attention to pulmonary collapse following diphtheria. In 1910 the first case of postoperative atelectasis was recognized clinically, also by Pasteur.[2] Scott,[3] in 1925, in a complete study of the literature found only 64 cases reported, these included cases which were not postoperative. Previously often mistermed postoperative or ether pneumonia, atelectasis has been recognized with increasing frequency since 1925 as a common pulmonary complication following operations, so that now it is variously estimated as comprising from 20 per cent to 70 per cent of all postoperative pulmonary complications.[4,5]

Atelectasis may be defined as the collapse of a lung or portion of a lung in such a manner that the affected portion contains little or no air and is greatly decreased in size. Most authorities, including Coryllos,[6] Mathes and Holman[7] and Bergh[8] consider inspissated secretion to be the primary cause, following the evidence presented by Jackson and Lee[9] and Elliot and Dingley.[10]

The mortality of atelectasis, per se, is low, but as Faulkner[11] points out, postoperative massive collapse is of more than academic interest because it may be complicated by either a bronchopneumonia or a labor pneumonia with fatal results. When precautionary measures are neglected or proper treatment is delayed, true pneumonia, pulmonary abscess or empyema may be the outcome.*

Eliason and McLaughlin[14] at the University of Pennsylvania Hospital have published recently the results of their observations on postoperative pulmonary complications. They found a total of 129 such complications following 8864 operations in ten years. Of these, 32 were cases of atelectasis.

At Evanston Hospital, a five year period extending from June 1930 to June 1935, was studied. Since an atelectasis card has been included in the files only during the past year, the cases were found only after searching through all other postoperative pulmonary complications, such as pneumonia, bronchitis, etc. A total of 12,494 operations under general and local anesthesia were performed during that five year period. The total number of pulmonary complications were 77. These were proportioned as shown in Table 1.

TABLE 1
POSTOPERATIVE PULMONARY COMPLICATIONS IN 12,494 OPERATIONS

	Cases	Per Cent
Bronchopneumonia	19	24.6
Pulmonary infarct and embolus	13	16.8
Lobar pneumonia	10	12.9
Bronchitis	10	12.9
Hypostatic pneumonia	9	11.7
Pleurisy and pleural effusion	8	10.3
Atelectasis	8	10.3

* Coryllos and Birnbaum even go so far as to claim that every case of pneumonia is preceded by an atelectasis. Head,[13] however, believes that there is none of the evidence presented by these authors in support of their theory which cannot be explained just as easily in simpler fashion.

To the 8 cases of postoperative atelectasis occurring during the five year period are added 2 cases which have occurred since June 1935, so that a total of 10 cases are included in the report. In one patient atelectasis occurred twice, once following appendectomy, the other following intestinal obstruction eight days later, thus the 10 cases are taken from nine patients.

The years in which these diagnoses were made are as shown in Table II.

TABLE II

	Cases
1930	1
1931	0
1932	0
1933	3
1934	1
1935	5

Three cases were in patients below ten years of age, 6 cases in patients between twenty and forty. Seven were in males, 3 in females.

TABLE III
AGE INCIDENCE

Years	Cases	Per Cent
0 to 10	3	30
10 to 20	1	10
20 to 30	2	20
30 to 40	4	40

TABLE IV
SEX

	Cases	Per Cent
Males	7	70
Females	3	30

Five cases followed appendectomies, one case followed each of the following: intestinal obstruction, cholecystectomy and appendectomy, gastrojejunostomy, defundectomy, and drainage of prostatic abscess. Worthy of note is that 80 per cent of the cases occurred following lower abdominal surgery, which is contrary to the findings of Head,[15] Eliason[16] and others, who claim that high abdominal operations are more frequently followed by atelectasis, due to the fact that these operations restrict the diaphragm more thus decreasing forceful respirations and concomitantly, vital capacity.

However, one important factor in the development of atelectasis would seem to be injury to those muscles which help force the air out in expiration. The obliques, most commonly cut in appendectomies and hernial repairs, play an important part as accessory muscles of respiration. Scott's[17] collection of all cases reported up to 1925 seems to support this, since of the 64 cases, 11 were hernias and 17 were appendectomies. These two operations led all others easily in frequency and together made up nearly half of the total number of cases.

This series of cases is hardly large enough to draw any conclusions as to the part that anesthesia plays in production of atelectasis. (Table V.) Brown[18] believes that spinal anesthesia predisposes to atelectasis, due to its marked depression of the respiratory center, not only during the operation itself but for a considerable period thereafter.

TABLE V
ANESTHESIA

	Cases	Per Cent
Ether	5	50
Ethylene	3	30
Spinal	1	10
N_2O	1	10

Premedication was morphine and atropine, or scopolamine. One case received atropine alone. (Table VI.)

TABLE VI
PREMEDICATION

	Cases	Per Cent
Morphine sulphate and atropine	6	60
Morphine sulphate and scopolamine	2	20
Atropine	1	10
Morphine sulphate	1	10

Atropine, of course, tends to thicken secretions, thus producing a condition which would seem to be favorable toward

the production of atelectasis. That it played only a minor part, if any, is indicated by the fact that 3 cases received no atropine at all.

In 60 per cent of the cases the operation consumed more than one hour; 40 per cent less than one hour; 50 per cent received intravenous therapy postoperatively, 50 per cent did not.

The onset in the majority of the cases was quite typical, 70 per cent of the cases occurring the first three postoperative days. (Table VII.)

TABLE VII
TIME OF ONSET

Postoperative day	Cases	Per Cent
1st	4	40
2nd	1	10
3rd	2	20
4th	1	10
Over 4 days	1	10
Date not known	1	10

The atelectasis was ushered in in most cases with a sharp rise in temperature followed within a period of hours by cyanosis, shortness of breath, pain in the chest and increase in respiratory rate and pulse. Very significant is the fact that in 8 cases a history of inability to raise mucus, expectoration or coughing, occurred before the onset of the atelectasis. The temperature, pulse and respiration curves are very typical, the sharp rise being noted in all but one case. (Figure 1.)

TABLE VIII
LUNG TISSUE INVOLVED

	Cases	Per Cent
Entire right side	1	10
Right lower lobe	7	70
Right middle lobe	1	10
Right upper lobe	1	10

Physical findings are difficult to analyze. Head[19] claims that if the typical signs of atelectasis are not present, we are not dealing with an atelectasis. On the contrary, Van Allen[20] claims that many cases of atelectasis are misdiagnosed because of a lack of pathognomonic signs, the physical findings being modified, or difficult to

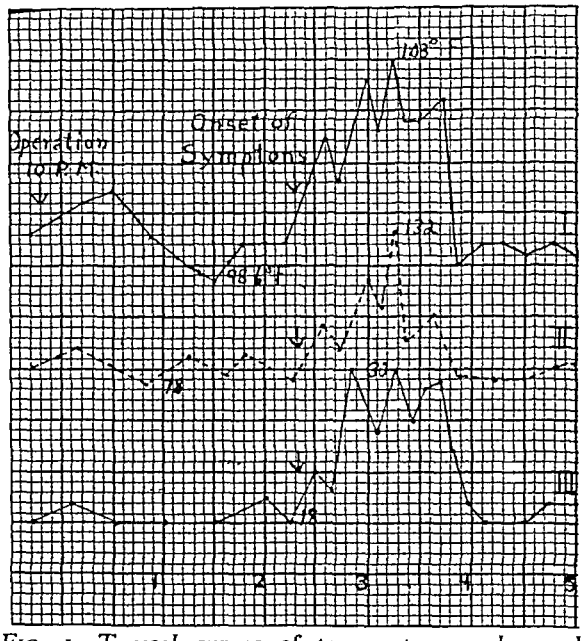


FIG. 1. Typical curves of temperature, pulse and respirations in a case of postoperative atelectasis. Vertical in graph I shows temperature in degrees Fahrenheit; in graph II, pulse rate per minute, in graph III, respirations per minute. Horizontal represents days postoperative. Case V. Typical of majority of cases.

ascertain, by the amount of surrounding normal lung tissue. The lung tissue affected is as shown in Table VIII.

Physical findings showed dulness to percussion in all cases over the affected area. Breath and voice sounds, which textbooks claim are always absent, were absent in 50 per cent of the cases, increased in 40 per cent and not charted in one case. As Scott[21] emphasizes, even when the breathing is largely suppressed there is often a bronchial quality to the sound that is heard. This factor easily gives rise to errors in physical diagnosis. Râles may or may not be present.

Restricted respiration on the affected side was noted in 3 cases on physical examination. In most of the cases no mention was made of observation of respiration or of a mediastinal shift. Sante[22] states that the mediastinum may remain undisturbed in the midline. The trachea alone may shift to the affected side. In

children, a scoliosis is a common finding, the concavity being directed toward the affected side.

The lack of uniformity in physical findings in so far as breath sounds are concerned demonstrates the importance of *x*-ray evidence. Nine of the cases were diagnosed as atelectasis by *x*-ray, one case had no *x*-ray. The importance of *x*-ray in diagnosis cannot be stressed too strongly. It is brought out clearly by Table IX, which is possibly the most instructive in the report. This table deals with the diagnosis made before *x*-ray findings.

TABLE IX
CLINICAL DIAGNOSIS MADE BEFORE *x*-RAY

	Cases
Not diagnosed	1
Atelectasis	3
(In only one case was a positive diagnosis made.)	
Bronchopneumonia	3
Postoperative pneumonia	1
Pleural effusion	1
Bronchitis	1
"Focus of infection"	1
Serofibrinous pleurisy	1

To summarize, a total of twelve diagnoses were made clinically, some cases receiving two diagnoses. A positive diagnosis of atelectasis was made in only one case. In 2 additional cases atelectasis was considered as a possibility. Thus in only one-fourth of the diagnoses was atelectasis even considered. This may well be contrasted to the statistics, quoted before, that 20 to 70 per cent of all pulmonary complications occurring postoperatively are atelectatic.

A history of upper respiratory tract infection preceding operation was found in 30 per cent of the cases, a high figure when the total number of operations is considered.

The atelectasis cleared the second day of its course in 50 per cent of the cases, while 80 per cent had cleared the third day. In almost every case relief came abruptly, with a fall in temperature and pulse rate to close to normal in a matter of several hours. Complete relief of symptoms, almost dramatic in character, was the rule. Coughing and expectoration of mucus usually continued for several days.

In one case, the atelectasis persisted until the day of discharge, the thirty-eighth postoperative day. Since it was discovered the day of discharge, no treatment had been instituted.

The frequency with which an incorrect diagnosis was made in these cases is perhaps paralleled by the diversity of treatment prescribed. Careful study of the records, including nurses' bedside notes, revealed that in only 3 cases was the type of treatment administered designed to correct the underlying cause. These 3 cases were relieved almost immediately and dramatically. Even after *x*-ray diagnosis was made, most treatment seemed to be directed toward controlling the cough.

From these statistical data presented, four important deductions may be made:

1. The clinical diagnosis is difficult.
2. Early *x*-ray examination in postoperative pulmonary complications is of first importance in making a diagnosis.
3. Proper prophylaxis definitely decreases the incidence of atelectasis.
4. The proper method of treatment is not commonly understood. When it is employed, the recovery is much more rapid.

1. *The clinical diagnosis is difficult.*

Nine additional cases were studied. These cases were chosen among the pulmonary complications as being most likely cases of atelectasis, but were not included in the report since neither a positive clinical nor *x*-ray diagnosis was made on them. In only one of them was atelectasis even considered in the differential diagnosis. They were diagnosed as shown by Table X.

TABLE X

	Cases
Bronchopneumonia	5
Lobar pneumonia	1
Hypostatic pneumonia	1
Pulmonary infarct	2
Bronchitis	1

Despite the diagnosis made on them clinically, atelectasis must be considered as a possibility in every case because of typical temperature, pulse and respiration curves and physical signs. In 6 of the 9 cases the

duration of the complication was less than forty-eight hours, with an abrupt rise and abrupt fall in temperature and pulse

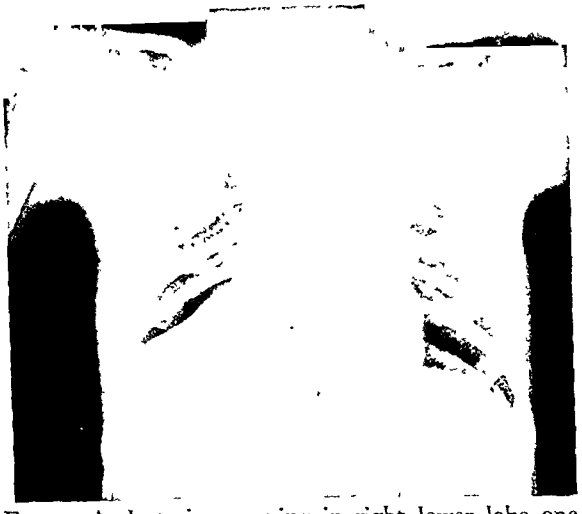


Fig. 2. Atelectasis occurring in right lower lobe one day following operation for appendicitis. Case III. No marked shift of mediastinal structures.

curves. Absent breath sounds were noted in 45 per cent of the cases. Mucus, postoperatively but previous to the onset of the complication was noted in 6 of the 9 cases. *X*-rays were taken in 6 cases, 2 of which were negative but were taken eighteen to twenty-six days postoperatively. In 2 cases, films were unsatisfactory, and the last 2 cases are possible atelectasis. (Crowder.[23])

The purpose of including these doubtful cases is not to prove necessarily that they are all errors in diagnosis, but to further demonstrate the important fact that atelectasis is not being considered often enough in the differential diagnosis of postoperative pulmonary complications. It is in diagnosing and treating early complications as cases of pneumonia, rather than as atelectasis, that the danger lies. (Faulkner.[24])

The onset and symptoms, according to Faulkner[25] may vary somewhat according to the suddenness in onset of bronchial plugging, size of plugged bronchus, alterations in intrapleural pressure and disturbance in position of mediastinal structures. Sante[26] claims that at times it is impossible to make a differential diagnosis between bronchopneumonia and atelectasis. This is true when a case of atelectasis has been allowed to continue for several days without proper treatment. The lung starts to expand, but atelectatic areas are still present, thus giving a condition simulating

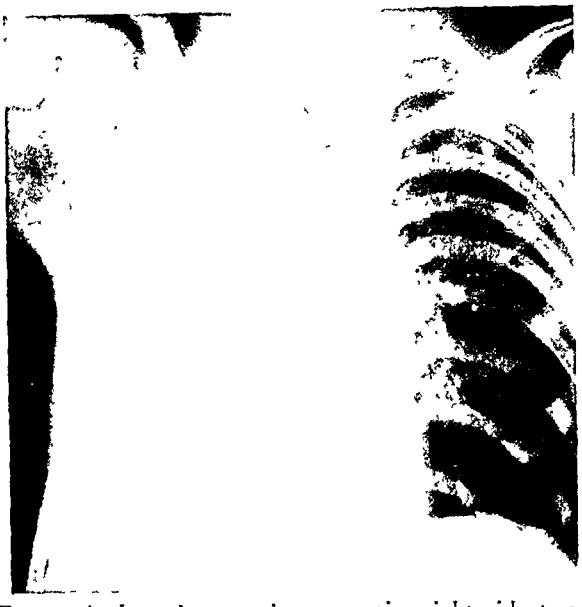


Fig. 3. Atelectasis occurring on entire right side two days following operation for intestinal obstruction. Case IV. Mediastinal structures far to right.

bronchopneumonia closely both by physical findings and by *x*-ray.

II. *Early x-ray examination in postoperative pulmonary complications is of first importance in making a diagnosis.*

The *x-ray* findings are summarized by Sante[27] and Van Allen.[28] The half of the diaphragm on the affected side is elevated, the rib interspaces are narrowed, the mediastinal structures deviated to the affected side, and the lung tissue affected gives a homogenous shadow. (Figures II and III.) Sante[29] adds however, that when a single lobe alone is affected, such as the lower lobe, the heart and trachea may remain undisturbed in the midline, the space lost by atelectasis of a single lobe being taken up by a compensatory emphysema of the uninvolved portion of the lung. In children scoliosis is found often.

The fluoroscope frequently plays an important part in the diagnosis of an atelectasis, being of value chiefly in children due to the mobility of their mediastinum and their inability to cooperate. In one of our cases, the child could not be induced to hold his breath in

full inspiration, the resultant roentgenogram showed the heart and mediastinal structures exactly in the midline. Fluoroscopic examination however, showed these structures definitely move toward the affected side in inspiration.

In stressing the importance of *x*-ray findings, there is no intent to create the impression that physical findings are valueless or that a diagnosis cannot be made on the basis of physical findings alone. Such is not the case, although physical findings are definitely subordinate to the roentgen ray in a not inconsiderable proportion of cases.

III. *Proper prophylaxis definitely decreases the incidence of atelectasis.*

Prophylaxis is simple and should be standard in all hospitals. Deep breathing exercises for every postoperative case is desirable. Slow inspiration and expiration ten times per hour every waking hour. If the patient is not breathing deeply, carbon-dioxide oxygen inhalations two or three times every one-half hour should be added. No operation should be performed, except emergencies, when any condition predisposing to excessive secretion is present, e.g., sinusitis, laryngitis, bronchitis, etc. Faulkner[30] points out that atropine thickens secretions and should be used sparingly or not at all postoperatively. This view is shared by Alexander.[31] Brown[32] claims that the viscosity of the mucus determines whether a lobar or lobular atelectasis occurs, the more viscus mucus blocking off larger portions of the lung.

Stormy anesthesia predisposes to atelectasis. A patient on the table often becomes restless, vomits a little and the anesthetist may clamp a mask over his face. Crowder[33] believes foreign body from vomitus to be one of the common causes of atelectasis. The pharynx, during anesthesia, must be kept clear of excess mucus by aspiration.

Postoperative medication should be given carefully. Morphine depresses the cough reflex. However it also diminishes the pain on respiration thus allowing the lungs to get better ventilation and increase the vital capacity. Thus a happy medium, where the cough reflex is maintained, should be desired. The patient must be urged to cough. KI and NH_4Cl by reducing tenacious sputum, are useful drugs postoperatively. Dehydration plays a part in the production of atelectasis postoperatively by making secretions thicken, thus tending to form mucus plugs.

Posture is extremely important. The Trendelenburg position is indicated in every patient who has had an upper respiratory tract infection previous to operation, who has had a stormy anesthesia, or who is raising large quantities of mucus postoperatively, unless it is contraindicated by the surgical condition, as in peritonitis. All patients should have their positions changed frequently the first few postoperative days. Distention of the bowel or stomach, because it tends to elevate the diaphragm, should be relieved.

Binders put on abdominal wounds so tightly as to affect respiration reduce the vital capacity of the lungs and tend to hypoventilation, one of the predisposing causes of atelectasis.

IV. *The proper method of treatment is not commonly understood. When it is employed, the recovery is much more rapid.*

After the condition has been established, actual treatment is simple and gives dramatic results. Head[34] tells of a case occurring in a week old infant, wherein the treatment consisted only of turning the baby in an effort to examine the back. This change in position caused the infant to cough up a large quantity of mucus. A few whiffs of CO_2-O_2 were then given in addition. The child was better almost immediately.

The patient should lie on the uninvolved side, rolled back and forth and urged to cough. Sometimes slapping the affected side, which is uppermost, is of value. Sedatives which diminish the cough reflex should be reduced to a minimum and breathing exercises should be instituted, plus CO_2 inhalations. If these simple but effective methods of treatment do not give

relief, resort must be made to bronchoscopy. An oxygen tent is sometimes of value.

The question of lobular, or focal atelectasis has not been discussed fully in this report. Eliason and McLaughlin[35] in their report of 30 cases had 18 lobar and 12 lobular. There is a very strong possibility that some of the 9 cases discussed in this report as doubtful were lobular atelectasis. Van Allen[36] claims that the majority of cases of postoperative atelectasis are of the focal or lobular form, and Brown[37] seems to have demonstrated quite definitely, both by iodized sputum injection in animals and bronchoscopic examination of clinical cases, the existence and mechanism of production of scattered lobular atelectasis. The similarity between lobular atelectasis and bronchopneumonia, both by physical and roentgenological findings, may lead to treatment for bronchopneumonia if careful diagnosis is not made. To treat atelectasis as true pneumonia may rob the patient of his chance for recovery.

If there is any doubt about the consolidation being due to lobar pneumonia, bronchopneumonia, pulmonary infarct, pleurisy with effusion, etc., a safe procedure which often establishes the diagnosis is to roll the patient upon his uninvolved side and urge him to cough.

SUMMARY

1. The clinical diagnosis is difficult and is seldomly made; the *x*-ray diagnosis is generally easy. The importance of early *x*-ray examination of all postoperative pulmonary complications is indicated.

2. Atelectasis probably occurs far more frequently postoperatively than is suspected.

3. Proper prophylactic treatment decreases the incidence of atelectasis.

4. The proper methods of treatment will greatly accelerate recovery.

5. A report of 10 cases of atelectasis occurring postoperatively is presented.

REFERENCES

1. Pasteur, Wm. *Internat. Jour. Med. Sci.*, 1890, 242, (Sept.)
2. Pasteur, Wm. *Lancet*, 2: 1080, 1910.
3. Scott, W. J. M. *Arch. Surg.*, 10: 78, 1925.
4. Henderson, Y. *Jour. Am. Med. Assn.*, 95: 572, 1930.
5. Mastics, E. A., Spittler, F. A., and McNamee, E. P. *Arch. Surg.*, 15: 167, 1927.
6. Coryllos, P. N. *Jour. Am. Med. Assn.*, 93: 98, 1929.
7. Mathes, M. E., and Holman, E. *Calif. and West. Med.*, 31: 386, 1929.
8. Bergh, G. S. *Minnesota Med.*, 16: 107, 1933.
9. Jackson, C., and Lee, W. *Annals Surg.*, 82: 373, 387, 1925.
10. Elliott, T. R. and Dingley, L. A. *Lancet*, 1: 1307, 1914.
11. Faulkner, Wm. and Faulkner, Edward. *Northwest. Med.*, 32: 87, 1933.
12. Coryllos, P. N. and Birnbaum, G. L. *Arch. Surg.*, 18: 191, 1929.
13. Head, Jerome. *Arch. Surg.*, 18: 223–5, 1929.
14. Eliason, E. L. and McLaughlin, C. W. *Surg. Clinics of No. America*, 14: 1–12, 1934.
15. Head, Jerome. Personal Communication.
16. Eliason, E. L. and McLaughlin, C. W. *Surg. Clinics of No. America*, 14: 5, 1934.
17. Scott, W. J. M. *Arch. Surg.*, 10: 81, 1925.
18. Brown, A. L. *Arch. Surg.*, 22: 981–2, 1931.
19. Head, Jerome. Personal Communication.
20. Van Allen, C. M., Lafield, W. A. and Ross, P. S. *Radiology*, 22: 28, 1934.
21. Scott, W. J. M. *Arch. Surg.*, 10: 83, 1925.
22. Sante, L. R. Annals of Roentgenology: A Series of Monographic Atlases. Edited by Jas. T. Case. Paul B. Hoeber, N. Y. Vol. II. The Chest Roentgenologically Considered by L. R. Sante, 1930, 385.
23. Crowder, E. R. Personal Communication.
24. Faulkner, Wm. and Faulkner, Edward. *Northwest. Med.* 32: 90, 1933.
25. Ibid. 32: 88, 1933.
26. Sante, L. R. Annals of Roentgenology: A Series of Monographic Atlases. Edited by Jas. T. Case. Paul B. Hoeber, N. Y. Vol. II. The Chest Roentgenologically Considered by L. R. Sante, 1930, 393.
27. Ibid. 2: 384. Annals of Roentgenology: A Series of Monographic Atlases. Edited by Jas. T. Case. Paul B. Hoeber, N. Y. Vol. II. The Chest Roentgenologically Considered by L. R. Sante, 1930.
28. Van Allen, C. M., LaField W. A., Ross, P. S. *Radiology*, 22: 28, 1934.
29. Sante, L. R. Annals of Roentgenology: A Series of Monographic Atlases. Edited by Jas. T. Case. Paul B. Hoeber, N. Y. Vol. II. The Chest Roentgenologically Considered by L. R. Sante, 1930.
30. Faulkner, Wm. and Faulkner, Edward. *Northwest. Med.*, 32: 91, 1933.
31. Alexander, John. Christopher's Textbook of Surgery, W. B. Saunders Co., Philadelphia, 1936, pp. 1005.
32. Brown, A. L. *Arch. Surg.*, 22: 977, 1931.
33. Crowder, E. R. Personal Communication.
34. Head, Jerome. Personal Communication.
35. Eliason, E. L. and McLaughlin, C. W. *Surg. Clinics of No. America*, 14: 8, 1934.
36. Van Allen, C. M., Lafield, W. A., and Ross, P. S. *Radiology*, 22: 35, 1934.
37. Brown, A. L. *Arch. Surg.*, 22: 977–8, 1931.

DIAPHRAGMATIC HERNIA*

ITS VARIETIES AND SURGICAL TREATMENT OF HIATUS TYPE

P. E. TRUESDALE, M.D., F.A.C.S.

Surgeon, Truesdale Hospital

FALL RIVER, MASSACHUSETTS

A REVIEW of the literature on diaphragmatic hernia discloses the controversial state of the subject. A more general understanding of the condition is important because of its disturbing influence on vital functions of the body.

At present the term diaphragmatic hernia appears to include every variety which occurs from birth to old age; therefore our present viewpoint on the various manifestations of this deformity needs to be clarified. Under the general title one author reports a series of cases entirely different from that of another who labors with his manuscript under the same caption. For example, diaphragmatic hernia in the newborn differs materially from that observed in children. Fundamentally and in many of the essential elements it varies from that encountered in later adult life. The only similarity between diaphragmatic hernia in the young and in the old is that each has a hollow viscus, or part of a hollow viscus, above the diaphragm. When the individual is at the meridian of life or later, the hernia is almost invariably of the hiatus type, not of congenital origin but acquired from a weak and gradually stretching musculature of the crura. In this, the most common form, we usually find the cardiac portion of the stomach protruding upward into the mediastinum through the relaxed pillars. By this process the peritoneum is pushed upward and forms a sac. Thus is developed a *hernia diaphragmatica vera* or true hernia. It is quite unlike the type of hernia found in children which develops through a deficiency not at the esophageal hiatus.

In this latter variety the important organs transposed are hollow viscera, including stomach, small intestine, and colon; the solid structures often herniated are the left lobe of the liver, the spleen and occasionally the pancreas. Grulee[1] stated that in this congenital type of hernia all the abdominal organs except the bladder, rectum and the genitalia have been found above the diaphragm.

Various classifications of diaphragmatic hernia have been set forth according to origin or location. Most authors use the classification of congenital, acquired or traumatic, based on the etiology, and true or false, with or without a sac. No classification presented thus far, however, appears to have served as a working basis of distinction in the bizarre manifestations of diaphragmatic hernia. This is not surprising, for it is now generally assumed that most hernias of the diaphragm have a congenital background and since the origin is due to a developmental defect, any form of irregularity may exist.

Although hiatus hernia often causes considerable disturbance to respiration, circulation, deglutition and digestion, it rarely terminates fatally. On the contrary, the type of hernia found in children often causes sudden death at birth or in the early weeks or months of life. Such deaths are so frequently ascribed to congenital heart disease or to enlarged thymus as to justify the attitude that in these cases opinion without postmortem evidence is unreliable. When autopsies on infants and

* Williamsburgh Medical Society, Brooklyn, November 11, 1935.

children are frequently done, more accurate figures on the incidence of congenital diaphragmatic hernia will be available. In over half the cases recorded, the children were stillborn or died shortly after birth from strangulation of the herniated viscera, acute dilatation of the stomach or asphyxia. Those who lived to reach adolescence suffered alterations of vital functions which were a constant threat to life. Symptoms resulting from the volume of transposed viscera varied in severity according to the degree of obstruction, torsion or intrathoracic pressure caused by the distention of the two gasbags, the stomach and colon.

Rarely an individual with diaphragmatic hernia lives to old age apparently unmolested, for by some chance the organs do not become obstructed. The structures in the thorax gradually become accommodated to the herniated viscera without causing embarrassment. In 1933 Jungfer[2] reported one of these cases in a man sixty-five years old. In the hernial sac resting above the diaphragm were the stomach and most of the omentum rolled into a ball, having herniated through the enlarged esophageal hiatus. Careful examination of the muscle fibers in the region of the hiatus showed structural weakness on the left side. The esophagus measured only 17 cm. Jungfer believed that this was a true esophageal hiatus hernia acquired early in life; the stomach entered the chest very early and since there was no traction on the esophagus it remained short.

In Bailey's[3] famous case reported in 1919 the man lived to be seventy-seven years old with no serious illness. The condition of the herniated stomach was revealed at autopsy.

In 1935 we reported a case seen at the Rhode Island Hospital.[4] The patient, a male fifty-eight years old, died from a strangulated inguinal hernia reduced *en bloc*. He had no complaints to suggest the presence of diaphragmatic hernia. At autopsy the entire stomach and omentum were found occupying a paramedial position in the right thoracic cage.

It is interesting to note that in these rare cases herniation occurs through the esophageal hiatus and the stomach is usually the only organ involved. Thus, if the stomach passes through the hiatus without becoming constricted and the diaphragm maintains its usual rhythmic movement, and if the crura do not impinge upon the cardiac portion of the stomach, this organ may remain in the chest throughout life without causing symptoms.

Even in the traumatic cases, symptoms often do not arise until years after injury. In Blum's[5] case, reported in 1896, symptoms arose eight years later; in Tatarinow's,[6] 1906, four years later; in Cranwell's[7] and Patel's,[8] 1908, several years later; in Grange's,[9] 1916, four years later, and in Polson's,[10] 1930, sixteen years later. In such cases, no doubt, certain changes occur in the hernia of a nature severe enough to impel the patient to seek relief.

In the congenital cases affecting children there were a few in which the condition was quiescent for many years. Newcomet's[11] nineteen-year-old athlete is a classic example. He did not complain of symptoms until he was seventeen, and two years later the condition was revealed by *x*-ray examination. Ager's[12] patient, a boy nineteen years old, died with the incorrect diagnosis of lobar pneumonia. Autopsy revealed the spleen twisted on its pedicle and fourteen inches of colon in the left chest. Keith's[13] patient lived to be nineteen before symptoms became at all troublesome, although it was known that the stomach had been in the right chest for seventeen years.

The presence or absence of a sac does not necessarily explain whether the hernia is congenital or acquired. Those through the foramen of Bochdalek[14] formed in early fetal life before the folds of pleura and peritoneum are present, are without a sac. In 1853 Bowditch[15] pointed out the fact that the right-sided congenital hernias almost invariably develop with a complete

sac, whereas those on the left usually have no sac. He showed also that hernia occurs more frequently on the left side, because the liver acts as a bulwark on the right; also the right crus of the diaphragm is longer and thicker and there are two fibrous bands on the right side which do not exist on the left. In any type a sac may or may not be present; about 90 per cent of those found in infancy and childhood are without a sac; in esophageal hiatus hernia we expect to find a sac.

Even the esophageal hiatus type of hernia admits of wide variation. For example, Makkas[16] described this condition in a man fifty-one years old. The *x*-ray film showed part of the stomach in the left chest and part in the right. At laparotomy a huge stomach was discovered in the chest, the diaphragm had lost all its convexity and the hernia sac was double, the heart resting on the diaphragm between the two sacs. The aperture at the hiatus was the size of a man's fist. The thorax contained the upside-down stomach, omentum and part of the transverse colon. A gastrojejunostomy was done but the patient died shortly after operation. Other complex cases have been reported with inverted and multilocular stomachs herniated through the esophageal hiatus.

It is evident, therefore, that the etiological background of this anomaly is so involved that all its manifestations are not easy to interpret. Like many other congenital defects, it opens up a vast field for conjecture.

The essential differences between hernia of the diaphragm in children and that observed in adult life are summarized in the following plan of classification. (Table 1.)

The two groups show a vast difference as to age, origin, location, amount of gastrointestinal tract transposed, solid viscera involved and symptomatology. They should be so differentiated when discussing the incidence of diaphragmatic hernia.

Few cases of congenital diaphragmatic hernia in children are reported. After a thorough search of the literature we discovered 303 cases, 165 of which were revealed at autopsy.[17]

TABLE 1

DIAPHRAGMATIC HERNIA

(Criteria of Differentiation)

In Children	In Adults
Development	
Congenital	Slowly acquired
Other anomalies present	No other anomalies
False (without sac) 90 per cent.	True (with sac)
G-I tract involved	Gastric cardia usually
Lung collapsed	Lung normal
Dextrocardia	Heart in normal position
Esophagus deflected	Esophagus contorted
Stomach inverted	Stomach upright
Extensive adhesions	Localized adhesions
Anatomy and Pathology	
Underdeveloped	Well developed
Undernourished	Often obese
Pigeon-breasted, funnel chest, rachitic rosary	Normal chest
Barrel chest	Broad habitus
Scaphoid abdomen	*Normal abdomen*
Poor posture	Normal posture
Esophagus normal length	Short esophagus
Symptoms and Morbidity	
Hemorrhage uncommon	Anemia, hemorrhage
No erosions	Erosion, ulcer, cancer
Intestinal obstruction	Obstruction rare
Cyanosis common	Cyanosis rare
Convulsions frequent	Not observed
Cough simulating pertussis	Cough rare
Physical signs simulate tuberculosis	Physical signs simulate cholecystitis, ulcer, cardiac embarrassment
Dilatation of stomach common	Rare
Operation imperative	Operation elective
Operative mortality 40–50 per cent	Operative mortality 5–10 per cent
Asphyxia most common cause of death	*Asphyxia* not a factor

On the other hand, numerous articles have appeared describing the esophageal hiatus hernia in adults. As early as 1896, Arnheim[18] reported a case of this type. The patient, aged thirty-two years, died of pneumonia and the hernia was found at postmortem examination. In 1903, Andrew[19] discovered a case which he described as diverticulum of the cardiac

end of the stomach. In 1908, Arnsparger[20] affirmed that from the time of Ambroise Paré's[21] traumatic case reported in 1610 not more than 10 cases of diaphragmatic hernia in any form had been recognized off the dissecting table. At first the small hernias were difficult to demonstrate in a roentgenogram. Faced with negative *x*-ray evidence to account for symptoms which simulated ulcer, cancer or gall-bladder disease, the roentgenologist finally came upon hernia of the diaphragm which, as late as 1924, had been discovered at the Mayo Clinic in any form only once in 18,000 examinations.[22] Now roentgenologists are more alert in searching for this deformity and more successful in finding it.

In 1924 and 1925, Healy,[23] Morrison,[24] LeWald,[25] and Carman and Fineman[22] reported their observations on hiatus hernia. In 1926 Akerlund[26] published a monograph describing three types of hernia which might occur through the esophageal hiatus: (1) that due to congenitally short esophagus; (2) the paraesophageal type in which a portion of the stomach herniates through the hiatus beside an esophagus of normal length; and (3) the type in which the lower end of the esophagus and more or less of the stomach herniate through the opening.

Anatomic studies of hiatus hernia together with results from medical and surgical treatment have been recorded by many authors.[27–50] A review of the works of these writers indicates the wide range of opinions expressed on all phases of the subject, the diversity of viewpoints and the lack of agreement as to the method of classification, interpretation of *x*-ray films and treatment.

Sauerbruch[51] represents one group which does not accept as true hernias Akerlund's third class of hiatus hernias. Von Bergmann[49] calls the condition the "epiphrenal syndrome" or *Traktionsluxation*. The condition is not a true hernia but hiatal insufficiency resulting from a minor loss of tone in the muscular portions of the crura of the diaphragm. Von Bergmann found this condition the sole explanation for epigastric pain, vertigo and anginoid symptoms in patients considered neurotics. He ascribed these symptoms to irritation of the vagus nerves which run through the hiatus and to ampullary changes in the lower esophagus. His pupils introduced balloons into the lower esophagus in dogs and by inflation produced a strong retardation of the coronary circulation and symptoms simulating angina pectoris. Thus it is apparent that in this anatomic region many reflexes are possible. Rigler and Eneboe[44] found hiatus hernia in many instances in pregnant women. Anders and Bahrmann[28] after studying 48 anatomical specimens demonstrated the increasing frequency of the condition with advancing age.

In many cases the hiatus hernia is not demonstrable until the patient has assumed a prone position. For this reason Sauerbruch rejected many cases diagnosed as hiatus hernias, considering the condition merely a weakness of the hiatus which permitted the lower end of the esophagus to be drawn up into the thorax where it became dilated or bell-shaped. He stated that when the esophagus was filled from above, a shadow was visible but it was not that of the stomach; it did not appear when the esophagus was empty even when pressure was applied to the abdomen and the patient asked to strain. Anders rejected all hiatus hernias if a sac were not present.

From many examinations during laparotomy it has been found that the muscular limits of the hiatus vary widely in normal people, and that this variation has no bearing on the origin of the hernia. In our examination of the hiatus in more than 200 laparotomies we have observed that the aperture opens and closes with respiration. There is a definite pinchcock action described by Hurst,[36] Bársony,[29] and others. When hernia exists at the hiatus there is an abnormal degree of separation made usually by a greater relaxation on the part of the musculature on the left side; Hurst and Dunhill[52]

state that in these cases the left crus has failed to develop. *If so, hiatus hernia should appear soon after birth.* We believe that the origin of hiatus hernia is in the musculature which has lost its tone, has gastrointestinal series at the Boston City Hospital and operated upon three. He concluded that relatively few hiatal hernias require surgery. Gardner[56] and Harrington,[34] however, report marked improvement after

TABLE II
10 MEDICAL CASES OF HIATUS HERNIA

Date	Sex	Age	Contents of Hernia Seen on *X*-ray	Duration Symptoms	Symptoms	Remarks
1929	F	54	Cardia	5 years	Dyspnoea, vomiting	Anemia; on diet
1930	M	67	⅔ of stomach	years	Precordial pain, vomiting, jaundice	Died in 6 months; carcinoma of pancreas
1932	F	58	⅔ of stomach	4 years	Palpitation, pain in left chest	Anemia; on diet; treated for heart trouble for years
1932	F	56	Upper loculus of hour-glass stomach	2 years	Indigestion, epigastric pain, cardiac symptoms	Anemia; on diet; ? ca. of stomach
1932	F	66	Cardia, part of fundus of stomach	10 years	Dyspnoea, fatigue, cardiac symptoms	Anemia; heart disease; ? gastro-intestinal malignancy
1933	F	77	Cardia, part of fundus of stomach	7 years	Epigastric pain, weakness	Cholecystectomy; symptoms persist; on diet
1933	F	74	⅔ of stomach	years	Vomiting, epigastric pain	Died 2 weeks later; no autopsy
1934	M	78	Cardia, "gastrocele"	years	Vomiting, chills, constipation, dyspnea	Heart disease; operation for empyema of gall bladder; hernia not cause of symptoms
1934	F	42	Cardia, part of fundus of stomach	2 years	Cardiac symptoms, dyspnea, epigastric pain	Supravaginal hysterectomy for fibroids; hernia not repaired
1935	F	58	Cardia	9 years	Palpitation, dysphagia, anginoid symptoms	Anemia; on diet; myocardial disease

become insufficient and yields to constant transcursion on the part of the cardiac end of the stomach.

TREATMENT

Treatment in these cases of esophageal hiatus hernia is still a subject of controversy. Anderson,[27] LeWald,[25] Fineman and Carman,[22] Koppenstein[53] consider operation contraindicated if the esophagus is short. Richardson,[54] Morrison[24] and Bock[31] represent a group reluctant to operate even in the face of serious symptoms. Ritvo[55] found 60 cases in 8000 operation. Symptoms disappear and there is often a rise in hemoglobin of 30 to 40 per cent. Further study will determine where medical treatment should end and surgical treatment begin. Failure to achieve cure by operation may be due to unusual findings or to faulty technique. Nissen[57] found surgery discouraging in these cases because the stitches pulled out and the crura separated. Richardson reported failure in two attempts to suture the hiatus.

Table II and Table III demonstrate cardinal symptoms in 28 cases of hiatus hernia, 10 medical and 18 surgical. The

Table III
18 surgical cases of hiatus hernia

Date	Age	Sex	Size of Hiatus by *X*-ray	Contents Herniated	Complications	Operation	Result*
1929	52	F	3 fingers	½ of stomach	Adhesions to sac, pericardium	Thoracic	Recovered
1930	52	F	3–4 fingers	Cardia	Ulcer, adhesions	Abdominal thoracic	Recurred in 4 years: ? carcinoma
1933	48	F	12 cm.	Hour-glass stomach	Stomach incarcerated, adhesions	Thoracic	Recovered
1933	43	F	3 fingers	⅓ stomach ? short esophagus	Diverticulum; heart disease	Thoracic	Improved
1934	48	F	3–4 fingers	7 cm. of stomach	Adhesions; dilated veins	Thoracic	Recovered
1934	65	M	4 cm.	7 cm. of stomach	Adhesions; bronchopneumonia	Thoracic	Recovered
1935	52	F	4–5 fingers	7 cm. of stomach	Stricture of esophagus, benign	Abdominal	Improved; bougie passed at times
1935	38	F	2 fingers	3 cm. of stomach		Abdominal	Recovered
1935	48	F	Small inconstant hernia		Eventration; phrenicotomy, 1 yr. previously	Thoracic	Plication of diaphragm; recovered
1935	52	F	4 fingers	8 cm. of stomach	Adhesions	Abdominal	Died; acute mediastinitis
1935	51	F	3–4 fingers	7 cm. of stomach	Old healed ulcer; adhesions	Abdominal	Recovered
1935	39	F	4 fingers	7 cm. of stomach	Adhesions to gall bladder	Abdominal	Improved
1935	55	M	4 fingers	5 cm. of stomach, ventral hernia	Colon, stomach adherent to diaphragm	Abdominal; repair of ventral hernia	Recovered
1935	63	F	3 fingers	5 cm. of stomach	Adhesions; diverticula, colon; hemorrhoids	Abdominal; hemorrhoidectomy	Recovered
1935	63	M	3 fingers	8 cm. of stomach	Short esophagus; inguinal hernia	Abdominal	Recovered
1935	46	F	4 fingers	Stomach, transverse colon in right chest	No mediastinum; dense adhesions	Thoracic	Died; acute mediastinitis
1935	52	F	3–4 fingers	Stomach upside-down, omentum in huge sac	Volvulus of stomach at pylorus, obstruction; dense adhesions	Thoracic	Recovered
1936	48	F	3 fingers	8 cm. of stomach	Adhesions to lung and diaphragm	Thoracic	Recovered

* Of these patients 16 recovered, 2 died, 4 were discharged improved. One patient has a stricture of the esophagus and returns to have bougie passed. In one case symptoms did not recur for four years, then *x*-ray revealed a probable carcinoma at the cardia. Two other patients still complain of mild symptoms. In 4 of the cases *x*-ray examination ten days after operation revealed a small portion of the cardiac end of the stomach above the diaphragm; the hiatus was smaller and symptoms have not recurred. The remainder have fully recovered.

series of adults comprised 5 males and 23 females. The average age was fifty-five years. These patients gave a history of long periods of epigastric distress, bloating, belching, nausea and vomiting, symptoms which were not relieved by alkalies, laxatives or enemata; anginoid pain sometimes completely masked the condition and was interpreted as due to myocardial damage. In 17 of the 28 cases the following diagnoses had been made before the patients were admitted:

TABLE IV

Diagnosis	*No. Cases*
Cholecystitis	8
Peptic ulcer	5
Mediastinal tumor	1
Carcinoma of stomach	1
Myocardial damage	1
Angina pectoris	1

In the remaining 11 cases hiatus hernia was suspected by the examiner and confirmed by the *x*-ray film.

Complications included ulcer of the stomach, benign stricture of the esophagus (2 cases), diverticula of esophagus and colon, ventral hernia, carcinoma of the pancreas, epithelioma of the face, fibroid uterus, myocarditis and bronchopneumonia. In one case treated medically a small portion of the cardiac end of the stomach protruded above the level of the hiatus taking the peritoneum with it but not developing a sac. This condition was more in the nature of a gastrocele. The patient, a man seventy-eight years old, complained of severe epigastric pain, vomiting, dyspnea and chills. An electrocardiographic tracing revealed myocardial disease; therefore operation was not done but a bland diet was prescribed and his condition improved. Six months later he returned with an acute abdomen, and a laparotomy on June 24, 1935, revealed empyema of the gall bladder. After a cholecystostomy his symptoms subsided and have not recurred. It is apparent that the complaints of this patient were due to the empyema of the gall bladder and not to the condition at the esophageal hiatus. He should have had a cholecystogram at the time of the first admission. Thus when a minor insufficiency exists at the hiatal region the hernia may be latent and symptoms the result of unrelated pathology.

Eighteen of the 28 patients were treated surgically after medical treatment had been tried over a reasonable period without relief. In 10 the approach was thoracic and in 8 abdominal. There were 2 deaths, one in each group, both the result of injury to the esophagus. With improved instruments and increased familiarity with the appearance of the esophagus and with the wide range of displacement which may exist, this risk has been eliminated.

OPERATION—CHOICE OF ROUTE

In determining the method of approach, many factors must be considered. Laparotomy is more direct, requires less time and produces less shock. Its application, however, has limitations. An extensively adherent viscus within the sac, coexistent with adhesions between the sac, lung, and pericardium may add much to the difficulties encountered at operation. The usual findings disclosed during thoracotomy were a herniated portion of the stomach in a sac, dilated peri-esophageal veins, and a network of adhesions between the hernial sac and diaphragm, pericardium and lung. This complication could not be dealt with easily from below.

As in traumatic cases and in congenital cases in children, adhesions and distended hollow viscera sometimes prevent reduction from below. In 1912 Fato[58] wrote that adhesions between stomach and pericardium made the thoracic route necessary. If the stomach were pulled down into the abdomen, traction on the pericardium would cause severe circulatory disturbance. Laparotomy was abandoned and the thoracic route employed by Frank,[59] Darvall-Barton,[60] Jopson,[61] Mann,[62] Hurst,[36] Fischer,[63] Lake,[39] and others. Olmstead[64] regretted that he had not used the thoracic route in a fatal case. Gibson[65] pointed

out the fact that when the stomach is markedly dilated, it cannot be pulled through a narrow aperture in the diaphragm from below. In one instance in which the patient died before operation could be done, Gibson wished that he had inserted a trocar directly through the anterior thoracic wall into the distended stomach. We suggest the use of the stomach tube in similar cases. In this instance the esophagus at the cardiac orifice and the duodenum just distal to the ampulla of Vater were occluded by pressure at the hiatus.

Quénu[5] cited Naumann's case reported in 1888 in which laparotomy was unsuccessful and thoracotomy was employed too late to save the patient. This is considered the first operative case of esophageal hiatus hernia recognized clinically. The same year Postempski[66] employed thoracotomy successfully in a traumatic case in a young boy.

The *x*-ray film is of assistance in determining the method of approach. When the cardiac end of the stomach, which is visible by *x*-ray above the diaphragm with the patient in the Trendelenburg position, does not descend when the position is changed to the upright posture, we conclude that adhesions have formed between the stomach and the sac and employ the thoracic route. We do not maintain that adhesions of the stomach within the sac cannot be severed from below. With the cardia drawn down into the abdomen, adhesions within the sac are put on tension and their division, though somewhat difficult, can be accomplished. However, adhesions of the sac to the esophagus, pericardium and pleura are shut off from the abdomen and their division becomes difficult, if not impossible. In dealing with the sac from below, a comparatively simple technique is to incise the peritoneum at the level of the diaphragm, establish a plane of cleavage which can be continued beneath the serosa lining the entire sac and remove the serous coat to the level of the pillars.

SURGICAL REPAIR OF THE HIATUS

Whichever method of approach is employed, operation is predicated upon the knowledge that acquired hiatus hernia in the adult presumably is caused by a loss of tone in the diaphragmatic musculature partially encircling the esophagus. It occurs more commonly on the left side. Digital examination of the hiatus during laparotomy or thoracotomy detects these bilateral muscle bundles which contract with inspiration and relax with expiration. During expiration the whole diaphragm is higher, even the central portion, while during inspiration the diaphragm descends and the hiatus closes as the dome flattens. When the muscles around the hiatus contract they descend and embrace the esophagus. Thus we observe one of the most interesting phenomena in the human body, the milking action at the lower end of the esophagus, a factor in the mechanism which makes swallowing independent of gravity. After mastication the food receives its impulse for deglutition from the musculature at the pharynx with which is coördinated the milking action at the hiatus; by this timing mechanism the food is carried downward by the peristaltic wave in the esophagus and retarded at the cardia before gentle pulsion carries it into the stomach in a left lateral direction.

A loss of tone and an abnormal spreading of the muscle structure forming the hiatus result in what might be termed a weak milking hand with retardation of the food column before it enters the stomach. As a rule, the muscle bundle on the right side has yielded little if any, whereas that on the left has stretched in minor or major extent, depending on the individual case. The widening of the hiatus is gradual, the slack usually extending laterally toward the left.

REPAIR BY THE THORACIC ROUTE

Although various methods have been described to open the chest wall, we believe the operation employed by Roberts of

London in most cases gives a satisfactory exposure. After making the customary incision through the soft parts, he divides

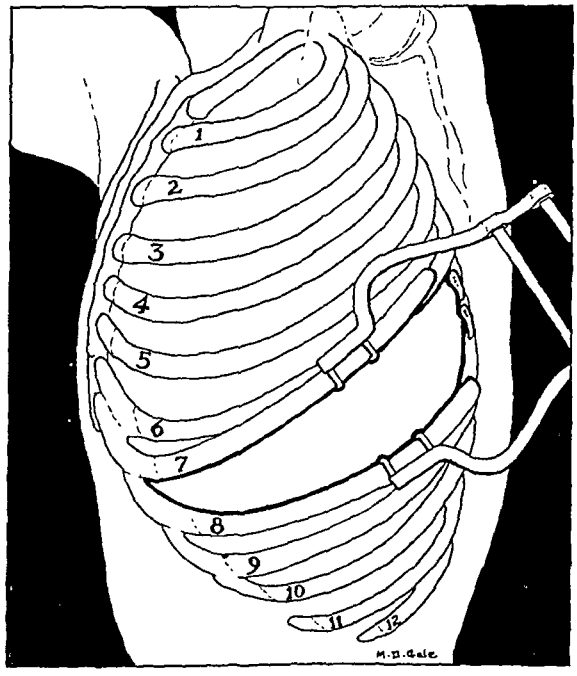


Fig. 1.

one or more ribs, usually the seventh and eighth, posterior to the tubercle. The intercostal pleura is then divided along the entire length of the incision. The use of a self retaining retractor with or without illumination gives adequate approach and light, to expose those parts of the diaphragm which ordinarily are considered inaccessible. (Fig. 1.)

In spite of the apparent logic of saving ribs, we have found that under certain circumstances such as the repair of very extensive apertures, it is unquestionably helpful to excise one or more ribs, particularly when the hernia occurs at the foramen of Bochdalek. If there is no sac, adhesions are severed and the herniated organs reduced. If a sac is present, it is dissected free from adhesions and removed at the level of the diaphragm. The aperture at the hiatus of the diaphragm appears as in Figure 2. The outer extremity of this opening is seized with a pair of intestinal forceps and drawn laterally so that the borders are taut. (Fig. 3.) These edges are then brought into apposition with a running suture of silk reinforced with interrupted sutures of the same material. (Fig. 4.) After the hiatus has been repaired, the thoracic wall is closed by interrupted sutures of silkworm gut. In placing the sutures we find the Reverdin needle useful and timesaving.

REPAIR BY THE ABDOMINAL ROUTE

Through an abdominal incision the hernial orifice is seen from below after the stomach has been drawn down and the margins of the opening identified. (Fig. 5.) The relaxed crura in the form of a rounded muscle bundle are grasped with intestinal forceps and drawn into the field of operation. Bearing in mind the fact that the normal hiatus permits the introduction of one or two fingers, care must be exercised not to suture the musculature too closely about the esophagus. In placing sutures a metal depressor about one inch in width is used to guard against trauma to the esophagus. (Fig. 6.) If the muscle on the weak side is but slightly relaxed, the two sides may be evenly apposed by placing sutures vertically anterior to the esophagus, thus reducing the size of the hiatus to approximately normal. (Fig. 7.)

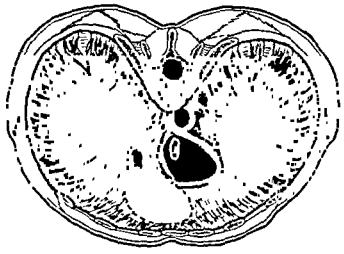


Fig. 2.

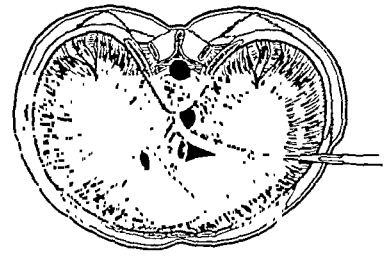


Fig. 3.

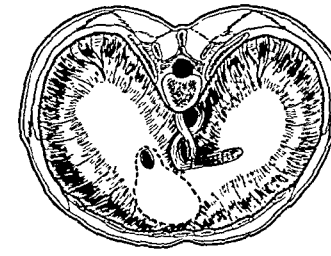


Fig. 4.

This method of repair, however, has one objectionable feature; the sutures, intended to close the hiatus, are actually uniting the two halves of the diaphragm. With the constant rhythmical contraction and relaxation of both sides, the strong traction exerted on the suture line is liable to result in a recurrence of the hernia. Consequently, the undesirably preoperative measure of phrenicotomy is practised routinely by some surgeons.



Fig. 5.

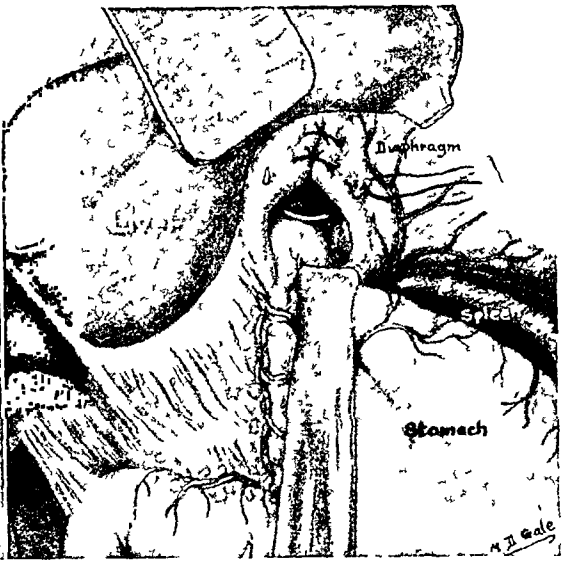


Fig. 6.

In a typical left sided hiatal hernia the relation of the two sides of the hiatus is in the form of a triangle with the right muscle bundle as its base. To suture this triangle vertically, sutures must be taken at greater intervals on the two left sides, resulting in a shirring on the left side. If both sides of this triangle, however, are brought together horizontally or laterally at a tangent, as in Figure 8, closure of the hiatus is limited to an operation on one leaf of the diaphragm; consequently there is less tension on the sutures and a decrease in the liability to a recurrence.

Closing the anterior angle vertically by two or three interrupted sutures, as in Figure 9 adds somewhat to the strength or holding capacity of the horizontal sutures as in Figure 10.

This operation employed to approximate the pillars of the diaphragm is somewhat similar to that used in uniting the levator ani muscles to strengthen the pelvic diaphragm. There is an interesting analogy between the anatomy of the central portion of the diaphragm and the muscle structures of the floor of the pelvis which exercise control and support of the rectum. (Fig. 11.) The crura of the diaphragm are tendinous in structure at their point of origin. The right crus, larger and longer than the left, arises from the anterior common ligament and intervertebral substance of the three or four upper lumbar vertebra; the left from the upper two. They pass forward and inward and gradually converge forming an arch, beneath which passes the aorta and thoracic duct. From this arch muscular fibers arise which diverge, the outer portion coursing upward and outward to the central tendon, the inner decussating in front of the aorta and then diverging, so as to encompass the esophagus. Divergence of these crura varies widely as Eppinger[67] pointed out in 1911. Stadtmüller's[48] experiments, however, proved that this variation had no causal significance in the origin of hiatus hernia.

In most cases the esophageal hiatus is formed by muscle fibers from the right crus, though it may be formed by fibers from both crura. The muscle fibers of the

right crus divide, the weaker slip crossing over to the left side; with restricted exercise and the consequent loss of muscle tone

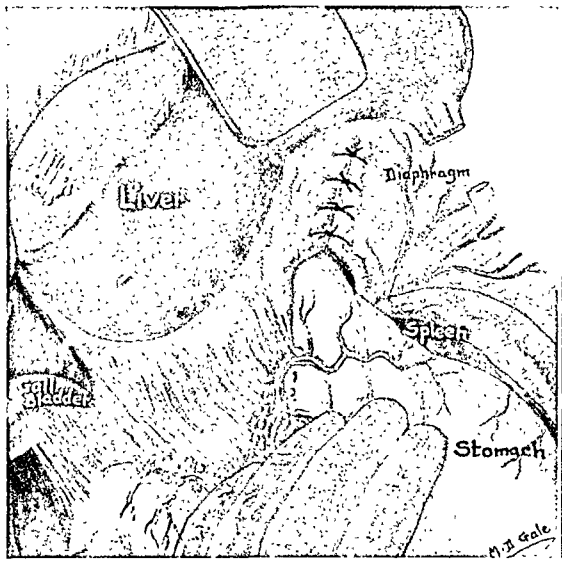


Fig. 7.

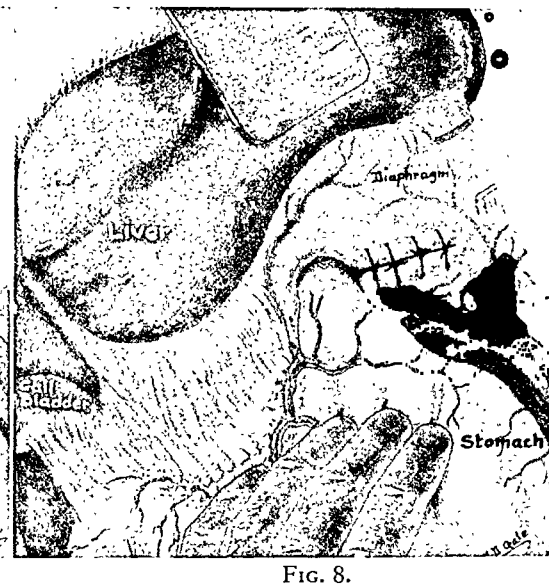


Fig. 8.

of advancing age, the musculature becomes slack and in certain individuals permits herniation of the stomach.

In a somewhat similar manner the levator ani muscles arise from the posterior surface of the body of the pelvis, the spine of the ischium and the lower border of the pelvic fascia and *spread out fanlike to form the diaphragm of the pelvis.* In the female the anterior fibers pass along the sides of the vagina and meet corresponding fibers of the opposite levator ani muscle in the interval between rectum and vagina, where they are inserted into *the central tendon of the perineum.*

When the crura of the diaphragm relax and separate widely, the stomach rises above the level of the diaphragm through the hiatus forming a gastrocele, just as relaxation and separation of the levator ani muscles in late adult life form rectocele

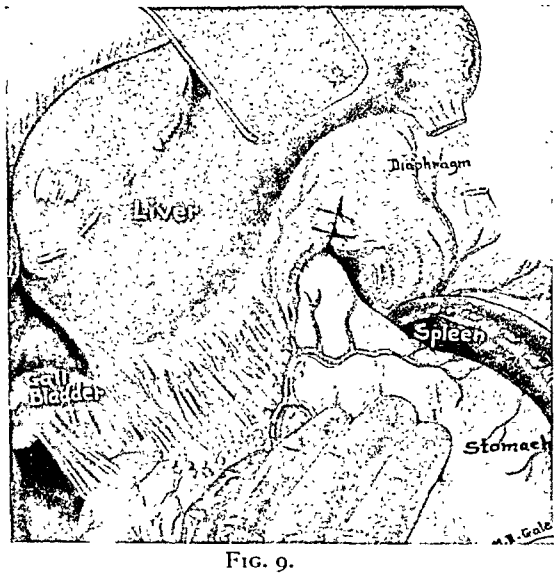


Fig. 9.

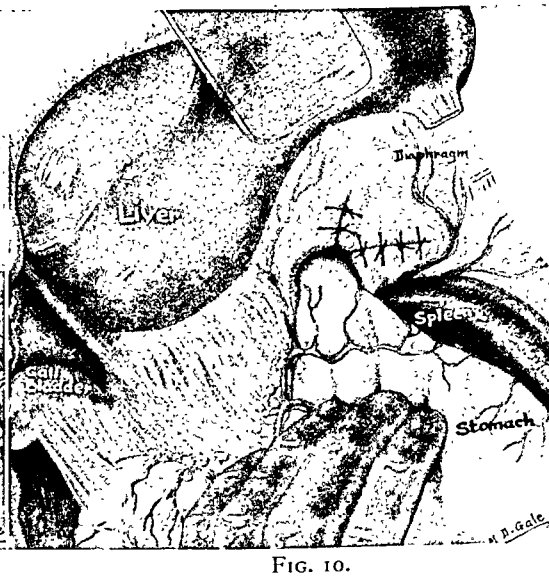
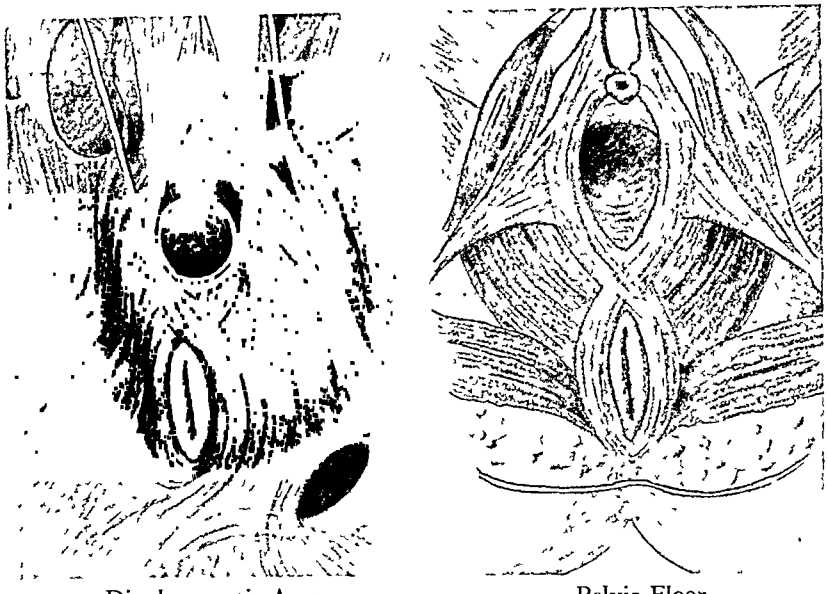


Fig. 10.

and procidentia; the rectocele is a bulging of the rectum upward through the pelvic diaphragm, the procidentia a true hernia through the pelvic floor. Here the analogy stops. At the anus is a distinct sphincter muscle which exercises voluntary control and is not constant in action, whereas at the distal end of the esophagus there is no concentration of muscle fibers into a definite sphincter muscle and the action of the diaphragm is involuntary and unceasing. Although Hurst,[36] Anders[28] and others mention a definite sphincter muscle bundle at the lower end of the esophagus visible microscopically, after a careful postmortem examination of more than 15 specimens, we have been unable to find a concentration of muscle fibers at this site. It is possible that hypertrophy of the muscular coat of the terminal esophagus may occur from continued spasm and chronic irritation resulting in a condition similar to that associated with ulcer at the pylorus or fissure at the rectum. Whatever mechanism exists at the cardia is involuntary in action and intended merely to retard the column of food before it enters the stomach. By the Germans this lower portion of the esophagus is called the loitering canal, *Verdauungskanal.*



Diaphragmatic Area Pelvic Floor

Fig. 11.

THE HERNIAL SAC

The problem of dealing with the hernial sac is difficult by either method of approach but less so from above. Sauerbruch[51] and Lake[39] found the sac more accessible when the thoracic route was employed. When dealt with from above it can be separated readily from adhesions and removed in a manner similar to that employed in umbilical or inguinal hernia.

Although removal of the sac is always desirable, before attempting this one should consider the barriers to be overcome. When the sac is inaccessible Fischer[63] is content to clip the peritoneum at the rim of the hiatus to secure wound flaps. Hinz,[68] Sauerbruch[51] and Harrington[34] maintain that the sac should be completely cut from its attachment to the stomach and to the hernial opening before actual closure of the hiatus. If left, it may press against the pericardium and cause distressing symptoms. Hinz plicates the sac when feasible, a method which we have used in 4 cases.

When approached from below, the sac is drawn down to a level where it is accessible, the serosa lining the sac above is stripped off and the entire sac dissected free and removed.

PHRENICOTOMY

In operations for diaphragmatic hernia evulsion of the phrenic nerve has been practiced by some surgeons as a routine preliminary measure. There is no doubt that this adds to the strength of the repair operation, but it must be borne in mind that following phrenicotomy alterations occur in the structure and function of the entire diaphragm. For this reason the wisdom of this procedure is questioned. In 1934 Stanbury[69] recorded changes in the diaphragm after phrenicotomy found at autopsy in 11 cases. Evulsion of the nerve was according to the method of Félix. The duration of the paralysis varied from three weeks to six years. Atrophy of the diaphragm was evident as early as the third week and was complete by the fourth month. In some cases the diaphragmatic leaf had stretched and become a thin whitish membrane of parchment thinness. Under the microscope the atrophy was complete and uniform. In one case a few normal muscle fibers remained, denoting an accessory nerve supply but no actual regeneration was visible. In 10 cases there was marked distortion of the abdominal viscera.

Should the surgeon believe that paralysis of the phrenic nerve will facilitate surgical repair of the hernia, temporary paralysis by crushing is preferable to permanent paralysis. Whenever the abdominal approach is used, temporary paralysis may be obtained by crushing or by injecting the nerve. The phrenic nerve is accessible as it courses downward over the pericardium and temporary paralysis may be accomplished by the injection of a 70 per cent solution of alcohol or by crushing it with a pair of ordinary hemostatic forceps.

CONCLUSIONS

The present misunderstanding in regard to the incidence of diaphragmatic hernia is due to a confusion of hiatus hernia with congenital diaphragmatic hernia.

Hiatus hernia is relatively common. It has become one of the important causes of symptoms in the upper abdomen to be excluded by the roentgenologist. When it causes anemia from chronic bleeding and complaints simulating cholecystitis, chronic pancreatitis or peptic ulcer, surgical treatment is advocated.

Congenital diaphragmatic hernia is a rare anomaly, almost invariably troublesome and requires operative treatment.

With a view to differentiating these two types of hernia a tabular comparison of their various manifestations is presented. Differences based on a comparison of the developmental, anatomical and symptomatological evidence are recorded in outline form.

The operative treatment, avenues of approach, associated problems and methods of dealing with the hernial sac are discussed.

REFERENCES

1. Grulee, C. G. *Internat. Clinics*, 2: 100, 1915.
2. Jungfer, G. *Virchows Archiv. f. path. Anat. u. Physiol.*, 289: 463, 1933.
3. Bailey, P. *Anat. Record*, 17: 107 (Oct.) 1919.
4. Truesdale, P. E. *New England Jour. Med.*, 212: 240 (Dec. 12) 1935.
5. Blum and Ombrédanne. *Arch. génér. de méd.*, 1: 5, 1896. From Quénu, J. Paris thesis, 1920.
6. Tatarinow. *Chir. russa.* 1906; from Quénu.
7. Cranwell, D. J. *Revue de chir.*, 26: 33 (Jan. 10) 1908.
8. Patel. *Lyon méd.*, 111: 387 (May 7) 1908.
9. Grange, C. D. *Brit. Jour. Surg.*, 4: 604, 1916–17.
10. Polson, C. *Brit. Jour. Surg.*, 18: 170, July, 1930.
11. Newcomet, W. S. *Atlantic Med. Jour.*, 29: 687, 1925–26.
12. Ager, L. C. *U. S. Vet. Bur. M. Bull.*, 6: 971 (Nov.) 1930.
13. Keith, D. Y. *Am. Jour. Roentgenol.*, 7: 289, 1920.
14. Bochdalek. *Schmidts Jahrbuch* 59: 206, 1848.
15. Bowditch, H. I. *Buffalo Med. and Surg. Jour.*, 9: 11, 1853.
16. Makkas, M. *Beitr. z. klin. Chir.*, 157: 623, 1933.
17. Truesdale, P. E. *New England Jour. Med.*, 213: 1159 (Dec. 12) 1935.
18. Arnheim, A. *Thesis*, Giessen, 1896.
19. Andrew, C. T. *Lancet*, 1: 792 (March 21) 1903.
20. Arnsparger, quoted by Unger, A. S. and Speiser, M. D. *Am. Jour. Roentgenol.*, 15: 135 (Feb.) 1926.
21. Paré, A. *Opera Chirurgica*, Frankfort, 30: 230, 1610.
22. Carman, R. D. and Fineman, S. *Radiology*, 3: 26 (July) 1924.
23. Healy, T. R. *Am. Jour. Roentgenol.*, 13: 266, 1925.

[*For Remainder of References see p.* 276.]

REGIONAL ANESTHESIA

A FEW GENERAL CONSIDERATIONS*

HENRY S. RUTH, M.D. AND JOHN A. STILES, M.D.

PHILADELPHIA

INTRODUCTION

STATISTICS pertaining to the problems on anesthesia, both regional and general, are very difficult to obtain. These shall continue to be unavailable in sufficient numbers to be of value until more of the larger clinics and hospitals adopt comprehensive records which may be applied to a sorting machine, and which are in use at the Mayo Clinic and the State of Wisconsin General Hospital. Until such time remarks concerning the use and efficiency of any one given agent or method throughout the country, shall of necessity be confined to impressions gained from (1) the few reliable statistics available, (2) perusal of the current literature on the subject, and (3) observations made during visits to various medical centres. We believe it may be deduced from these sources that regional anesthesia in the past half decade has not greatly increased in numerical usage, but that, generally speaking, where it has been applied it has rendered increasingly satisfactory results. This premise being true, we believe that it would be both interesting and instructive, to consider a few of the factors which possibly have largely contributed to this increased general efficiency.

PRELIMINARY MEDICATION

It appears that the application of the correct preliminary medication may be the largest single contributor to increasing success, particularly for the patients. The rather ephemeral spectre of psychic shock has run the gamut from derision to being termed a definite complication by neuropsychiatrists. Nevertheless, it is more comforting to patient, surgeon and anesthetist, to be able to work on a quiet, relaxed and cooperative patient. We, as medical specialists in the field of anesthesia, believe that this subject is neither sufficiently understood nor applied with interest and efficiency. The drugs and dosage selected for preliminary sedation for regional anesthesia are too frequently dismissed as a matter of routine procedure. It appears to us that the vast knowledge gained from experience in preliminary narcosis for general anesthesia might well be applied also to the field of infiltration or conduction anesthesia.

The aspects of preliminary medication we shall consider are:—(1) the objective to be attained, (2) the drugs employed, (3) the range of permissable dosages and the time of their administration and (4) factors influencing the dosage.

The two main objectives are to contribute to the comfort of the patient and to minimize the dangers accompanying the anesthetic and the operation. It may be said at this point, that we believe that patients are more cooperative toward regional anesthesia if they are not informed that this method of anesthesia has been selected, but are made aware of it only after they are properly premedicated and the time has arrived for the institution of the block.

A combination of several drugs may be used advantageously to accomplish these purposes. Morphine produces some analgesia for the slight discomfort of the induction of the anesthetic, and when combined with scopolamine provides somatic and psychic sedation. One of the barbiturates should be given in the majority of instances; they not only add to the hypnosis,

* Read before the American Society of Regional Anesthesia.

but also are a valuable protection against the possibility of a procaine reaction.

The choice of the barbiturate to be given will determine the time of its administration, since their action time varies and some are more rapidly eliminated. The two derivatives of barbituric acid we ordinarily use, are barbitol sodium and pentabarbitol sodium. Barbitol sodium is eliminated very slowly, consequently it should be given before retiring. Thus it will insure physical and mental rest for the patient during the night and still be present in the body to protect against procaine the following day. But it would be useless to employ this agent one-half to one hour before operation. The dosage varies from 5 (0.324 gm.) to 10 grains (0.650 gm.) in adults. Pentabarbitol sodium is absorbed rapidly and may be given at least one-half hour before induction of anesthesia, but as it is eliminated in four to five hours it is not effective when given the previous night. The adult dose of this drug ranges from 0.5 gr. to 3 gr. (0.0324–0.195 gm.) by mouth.

Morphine, alone or combined with scopolamine, should be administered by hypodermic one to one and one-half hours before operation to exert its maximum effect. The usual dosage employed in children when systemic disease is not present is 1/16 gr. (0.00405 gm.) from five to seven years of age; 1/12 gr. (0.00540 gm.) from eight to ten years of age; 1/8 gr. (0.00810 gm.) from eleven to fourteen years of age; over fourteen years of age the dosage is determined by the factors mentioned below, and will vary from 1/6 to 3/8 gr. (0.0108 gm. to 0.0243 gm.) or even more in occasional instances. Scopolamine when given with morphine is usually balanced in the ratio of 1/100 gr. (0.00065 gm.) with 1/4 gr. (0.0162 gm.) of morphine. Too great a degree of preliminary sedation should be avoided, because this state may either cause a patient to become restless from the lack of oxygen in extreme respiratory depression or the release of their inhibitions, or conversely, they may become so lethargic that they are unable to cooperate.

There are numerous factors which must be considered in deciding the dosage of all preliminary medication. (1) Is the age of the patient. Most of us are prone to exercise too great caution in children, when comparatively they will tolerate larger dosages than adults, but are apt to forget that the dosage must be diminished for individuals sixty-five years of age or older. (2) The factor of pain is important, since it increases the toleration to sedation, depending upon the intensity of the distress. (3) A patient exhibiting fever, especially of recent onset, will require more medication. On the other hand, one who has had a fever and has been bedridden over a long period of time, will permit considerably less than a normal individual. (4) Patients with specific toxemias, notably hyperthyroidism and neurosyphilis, are much more irritable than normal patients, and consequently more tolerant to larger doses. (5) Drug addicts, whenever possible, should first receive the usual dose of the drug to which they are accustomed, with the correct preliminary medication superimposed. If this is not practical, a much heavier dosage of the usual medication must be employed. (6) The factor of sthenicity is important and may be judged by the appearance of the patient and from a history of the type of work and recreation which he pursues. (7) The sex of the patient and the amount of apprehension manifested toward the procedure also exert their influence to complete the picture. After all these factors have been considered, the experience of the person prescribing guides him to select the proper drugs and their dosage.

AGENTS, PHYSIOLOGY AND PHARMACOLOGY

The same status exists regarding the agents employed for regional anesthesia as for the drugs available for therapy in numerous conditions where the ideal as yet has not been reached. Drug manufacturers have found a lucrative pursuit endeavoring to synthesize new agents as a substitute for procaine, and exploiting their supposed

advantages before sufficient experimental and clinical data have been accomplished. The result has been a flood of new agents on the market. It is true that many of these anesthetics have gained adherents, but, with the possible exception of metycaine, it appears that none of them may replace procaine in the entire scope of its applications. Some of these agents evidently possess increased efficiency in isolated instances, particularly for surface anesthesia, and some have their proponents for certain specific procedures. Nevertheless, it is conceded that procaine has not been approached for injection purposes, with regard to general reliability, consistency of action, low toxicity, and most certainly in the extent of both pharmocological and clinical study.

Reactions from procaine do not occur frequently and may be either mild or severe. In the literature the method of treatment for both types of reaction or the description of mild reactions, which possibly occur with greater frequency than is generally observed, are poorly described and insufficiently emphasized. Many times, procaine is injected with the utter abandon which may be employed with an inert substance. A knowledge of its toxic action and associated symptoms is too frequently not possessed or ignored by the administrator. The toxic symptoms which may develop are often interpreted as restlessness and incooperation on the part of the patient, or when more severe is attributed to other causes, as acute cardiac failure. It should be realized that procaine is a protoplasmic poison possessing an affinity for nerve tissue, therefore, large amounts present in the circulation will affect the central nervous system, particularly the brain and vital centres. Procaine injected into the tissues is gradually absorbed into the blood stream. Dunlop in his studies recently has shown that the liver, although not essential in the detoxification of procaine, performs this function more efficiently and rapidly than any other tissue, chiefly muscle. Thus he raises the question of the advisability of administering larger doses of procaine, as employed for local infiltration, to patients with impaired hepatic function. Procaine is excreted as such, or its end products, by the kidneys.

There are three main sources for toxic manifestations of procaine. The first of these is by overdose. Its toxicity is represented not by direct, but by geometric ration to its concentration. Various figures are given for the safe dosages with the indicated concentrations; from 300 to 750 c.c. of 0.5 per cent down to 20 to 60 c.c. of the 2 per cent solutions. Although the drug possesses a fairly wide margin of safety, these permissable dosages should be remembered and varied according to the physical condition of the patient. Too little also has been said of rapid injection and its effect on the rate of absorption. To decrease its absorption, and also to increase the length of anesthesia, epinephrine may be added and is effective up to a dilution of 1:50,000. Thus, 2 to 8 drops of a 1:1000 solution are added for every 100 c.c. Its addition should be guarded or eliminated, in the presence of thyrotoxicosis, any tendency toward vasoconstriction and for operations upon the fingers and toes.

The second method whereby toxic symptoms are produced is through idiosyncrasy. A case of apnea has been reported following the injection of 1 c.c. of 1 per cent procaine, and another where convulsions developed after the injection into the sacral canal of 3 c.c. of a 1 per cent solution. Where the idiosyncrasy is pronounced, warning may be given by the intradermal wheal becoming bright red, while a corresponding wheal with normal saline will not do so. Various grades of idiosyncrasy can be present, varying from the extreme, as the 2 cases cited, to faintness, dyspnea and excessive perspiration occurring several hours after the injection. Hewer reports a death following an injection of 16 c.c. of a 2 per cent solution. Lastly, toxic reactions are caused by an inadvertent intravenous injection. It has been estimated that the minimum

lethal intravenous dose is one-tenth that of the subcutaneous dose. When an intravenous injection is made, there is not a sufficient time interval for the detoxifying process into its end products to take place.

The toxic symptoms usually begin with restlessness and a state of confusion or apprehension, the pulse becomes slower and the blood pressure falls, the patient may complain of palpitations, the face will exhibit a pallor and be covered with cold perspiration; the finger tips, lips and ears may be slightly cyanotic; an increased respiratory rate, and nausea and vomiting may be noted. This same syndrome may be produced by a reaction from epinephrine, except that the pulse will become accelerated and the blood pressure increased, the former greater in proportion to the blood pressure rise. The pulse and the blood pressure, then, form the differentiating diagnostic factors. If the condition is progressive, or if an intravenous injection has been made, consciousness may be lost, the pupils dilate and convulsions may begin in a localized fashion in the face or in an extremity, and later become generalized. The respirations then become depressed, the blood pressure fall continues, and the pulse may remain slow or become rapid, due to anoxemia.

The treatment of these complications is comparatively simple and effective, the important initial step being the differentiation of the symptoms with regard to their origin. This is facilitated by keeping an accurate and constant observation of the blood pressure, a detail almost universally neglected with regional anesthesia, save in institutions having a well organized anesthesia department. If it is determined that the reaction is precipitated by epinephrine a few inhalations of oxygen suffice, for its action is evanescent and the condition will speedily wear off. If due to procaine, the patient should receive inhalations of oxygen, and a subcutaneous injection of epinephrine, minums 3 to 5, distributed over an area corresponding to the length of the hypodermic needle, followed by massage, or possibly better still, diluted in a small amount of saline, in order to hasten its absorption. If the situation is not under control and convulsions intervene, an intravenous barbiturate, such as sodium amytal or pentobarbital sodium, should be given very slowly until the convulsions are relieved. If depression is progressive to the extent that the minute volume respirations have fallen to an alarming degree, with a moribund patient, an endotracheal catheter should be inserted, and artificial respiration instituted with oxygen. If respiration suddenly ceases and no anesthetic machine is immediately at hand, mouth to mouth insufflation should immediately be done, until the arrival of the machine to continue artificial respiration. The interval consumed getting the machine after respiration has ceased, may be sufficient to cause death.

Cardiac depression is encountered rarely with procaine, and only after intravenous injection of large quantities. It has been demonstrated that if the respiratory depression is controlled by an efficient airway and by artificial respiration with carbon dioxide and oxygen, the blood pressure is elevated, color improves, and the resuscitation may be discontinued after there is evidence of the elimination of the drug, evidenced by the resumption of respiration. Although this latter reaction is very rare, knowledge of the correct form of treatment is a lifesaving factor, for it has been proved that ordinary circulatory and respiratory stimulants are of little value.

SCOPE AND GENERAL INDICATIONS

Regional anesthesia is perhaps the safest method of anesthesia at the present time, but it should be recalled that it is applicable only in a relatively narrow sphere. Difficulties are encountered when undue enthusiasm dictates its use where it may prove a deterring factor to the efficiency of the operation, or it is too difficult technically to induce, or where it is not indicated for psychological reasons. The

superiority of infiltration anesthesia for some minor operations, and in many instances on moribund patients, is indisputable. There are some situations where block anesthesia is of distinct advantage over inhalation types. Foremost of these are:—(1) complicating pathologies presented by the patient preclude the use of a general anesthetic or so reduce the permissible agents that the efficiency of the surgical manipulations are reduced, (2) its use will insure better surgical results, (3) certain anatomical regions facilitate its use, as anal margin operations and, (4) the economic aspects from the viewpoint of the patient.

A thorough knowledge of the possibilities of regional anesthesia are of particular value when pulmonary conditions will not permit satisfactory inhalation anesthesia. In this connection, we should not lose sight of the fact that fully as many, and in some instances, more postoperative pulmonary complications may follow regional anesthesia than carefully administered inhalation method. This is notably true of high spinal anesthesia for prolonged operations, probably because this procedure tends to materially reduce pulmonary ventilation during and for some time following the operation. An indisputable virtue of regional anesthesia rests with the ability of the patient to cooperate with and assist the surgeon in such operations as muscle transplants and multiple tendon sutures.

An important indication appears when the operative procedure interferes very little with the vital functions of the patient, but a prolonged inhalation anesthesia will needlessly affect metabolic activities. This is especially true when the operation demands complete muscular relaxation. Quite frequently a form of regional anesthesia will obviate prolongation of hospitalization, not required by a relatively minor operative procedure, particularly in many orthopedic manipulations and operations. On the other hand, when an operation is not apt to be confined in an area which is feasible to block, it may be an advantage to begin with some inhalation type of anesthetic. Thus the patient would not have to be subjected to two types of anesthesia with the attendant dangers of both.

Finally, the attempt should not be made to over-extend enthusiastically the use of regional anesthesia, so that the safety of the patient during the anesthesia and operation and his ultimate welfare are lost to view.

CONCLUSIONS

The efficiency and safety of regional anesthesia necessitates in addition to the usual technical experience of the anesthetist, (1) adequate preliminary medication, (2) a more comprehensive knowledge of the agents employed and, (3) a full recognition of its field of application.

RENAL ARTERIOGRAPHY*

PRELIMINARY REPORT OF EXPERIMENTAL STUDY

R. B. HENLINE, M.D., F.A.C.S. AND S. W. MOORE, M.D.

Associate Attending Urologist, New York Hospital (James Buchanan Brady Foundation); Attending Urologist, Manhattan General and New York Foundling Hospitals

Assistant Surgeon, Cornell University Medical School; Assistant Resident Surgeon, New York Hospital

NEW YORK CITY

THIS paper recounts our experiences with various contrast media for radiography injected into the aorta of dogs, in an attempt at visualization of the renal circulation.

The abdominal aorta of living humans has been directly injected successfully by several European observers and radiographs obtained of the arterial circulation. The renal artery and its branches have also been well visualized in some instances;[7,18] these have aided in diagnosis and any method of investigation which may assist in urologic diagnosis is, we feel, deserving of experimental study.

Radiographic study of the circulation is not new. The injection of contrast media into vessels for the purpose of obtaining radiographs of various portions of the circulation, dates back to Destot and Berard,[5] in 1896. It was not until 1923, however, that injection of the arteries in living humans with solutions rendering them opaque to the *x*-ray was first reported by Sicard and Forestier.[5] Barney Brooks,[3] in 1924, was the first to use 100 per cent sodium iodid to obtain arteriographs in the leg. In 1929 dos Santos, Lamas and Caldas first described a method of puncturing and injecting the abdominal aorta with opaque solutions to obtain an arteriograph of the visceral arterial circulation. This procedure has since been followed by several other Europeans.[4,12,19,21]

Dos Santos[5] stated that he has punctured and injected the aorta without a single accident in more than 300 living individuals. Balestra, however, states that dos Santos had 7 deaths following aortic arteriography, 5 of which occurred on the twentieth, sixteenth, fourteenth, sixth and fifth days respectively. These were unexplained except for some atheromatous changes in 3 cases. The sixth patient died from a hematoma and the seventh died following hysterectomy; in the latter case there was ecchymosis of the aorta although the needle puncture could not be seen.

Dos Santos'[5] technic is as follows: He inserts a needle, 12 to 14 cm. in length and 1.2 mm. in diameter, with a stylet, at the level of the twelfth dorsal and second lumbar vertebra. The stylet is withdrawn and from 15 to 20 c.c. of solution injected with a pressure of 2.5 Kg. and an *x*-ray taken immediately. A solution of 100 per cent sodium iodid or a mixture of ⅔ abrodil (85 per cent) with ⅓ sodium iodid (150 per cent) gives the best results. A general or spinal anesthesia is required because of the severe pain from the injection of these solutions. He states that from 40 to 45 grams of sodium iodid have been given without toxic symptoms. The only reactions he has encountered are dryness of the throat and mouth, passing sensations of great distress, and, rarely, subsequent acne, oliguria, albuminuria and diarrhea.[6]

The interpretations of the results shown in dos Santos' book offer excellent evidence of the diagnostic value of arteriographs. The aortic reflux, showing the contrast

* From the Department of Urology (James Buchanan Brady Foundation) of the New York Hospital and the Department of Surgery, Cornell University Medical College.

media rising above the level of the puncture, is the result of the constant pressure of the aortic injection during cardiac diastole. Tumors, cysts and aneurisms, as well as certain inflammatory lesions, may be visualized.

According to dos Santos,[8] arteriographic study of the renal circulation offers valuable information regarding the function of the kidney. A large renal artery would suggest an hypertrophy; a small one atrophy from some lesion interfering with the renal function, such as infection, tuberculosis or hydronephrosis, while absence of a pedicle signifies functional absence of the organ. The shadow of the kidney and its contour is much sharper than in simple radiographs. A darker radiograph of a kidney signifies the presence of more contrast media and hence a more normal kidney. Aberrant renal circulation is clearly outlined, so that one may diagnose not only a renal neoplasm, with its abundant circulation, but also a small vessel which may be the cause of a ureteropelvic obstruction. The renal area supplied by this artery may be outlined and renal anomalies clearly demonstrated with arteriography.

He concludes that since so much additional information is obtainable from arteriograms and since no accidents or complications have resulted from over 300 aortic punctures, this method of investigation should be frequently employed.

EXPERIMENTAL STUDY

Despite this enthusiastic report, we felt that more information should be obtained from animal experimentation before we could feel justified in employing the procedure in humans. Twenty-one dogs were therefore injected with solutions of sodium iodid of either 50 or 100 per cent, skiodan, uroselectan B, thorotrast, iopax or sterile normal saline.

TECHNIC OF INJECTION

The dogs were anesthetized with intraperitoneal injections of sodium amytal or by ether inhalation. The back was shaved and prepared at the left costovertebral angle. A needle with a stylet was



Fig. 1. Dog 11. Aorta injected rapidly with 10 c c. of 100 per cent sodium iodid. Note the reflux up the aorta. Right kidney is well visualized.

inserted two fingers breadth to the left of the spinous processes and just under the thirteenth rib medially and cephalad at an angle of about 15° until the body of the vertebra was met. By withdrawing the needle slightly and reinserting it at a smaller angle, the needle became tangent to the body of the vertebra and was inserted to the aorta. A definite resistance was encountered just before the aorta was punctured. As the aorta was punctured, the distal end of the needle pulsated with

each systolic contraction. On withdrawing the stylet, a spurt of arterial blood assured one that the aorta had been entered. A rubber tube connection permitted the dog to be placed on his back and the aorta injected with a luer syringe. *X*-rays were taken at varying intervals following injection of the drugs. In some instances an attempt was made to compress the iliac vessels or the lower portion of the aorta to obtain greater concentration of the injected fluid in the visceral circulation.

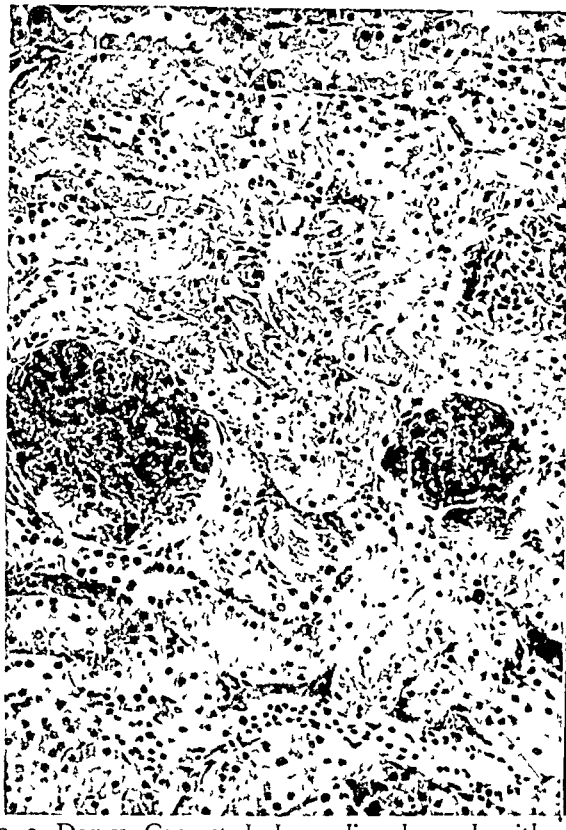


Fig. 2. Dog II. Congested glomeruli and vessels with some hemorrhage.



Fig. 3. Dog III. Aortic media is split and filled with blood clot. Note area where the needle punctured the aorta.

The following are brief résumés of our experiments:

Dog I. Intraperitoneal sodium amytal anesthesia. A Lindeman needle was tied in the femoral artery and a No. 4 F. ureteral catheter passed through the needle up the aorta above the kidney region. Ten c.c. of 100 per cent sodium iodid was injected and *x*-rays taken. *X*-ray: No arteriograph because of slow injection. The dog died in twenty hours. Autopsy showed fibrin and fluid in the left pleural cavity and inflammation of the peritoneum.

Dog II. Sodium amytal anesthesia. The abdomen was opened and the entire intestine, stomach and spleen removed. The aorta was punctured with a 20 gauge needle, 10 c.c. of 100 per cent sodium iodid injected rapidly and *x*-ray taken at once. (Fig. 1.) During the injection the surface of the kidneys assumed a mottled bluish color which increased as the sodium iodid was injected. The needle was removed and blood spurted from the aortic puncture for several minutes, and was stopped with difficulty. The kidneys became normal in color before the dog was sacrificed. Microscopic section of the kidney (Fig. 11) showed hemorrhage into some glomeruli and granular appearance of parts of the tubular epithelium.

Dog III. Sodium amytal anesthesia. An 18 gauge needle was inserted at the costovertebral angle into the aorta after several attempts, 10 cc. of 100 per cent sodium iodid injected, and *x*-ray taken at the end of the injection. After twenty minutes 10 c.c. more was injected and another *x*-ray taken. The needle was removed, and a hematoma rapidly developed in the

back in the region of the puncture. *X*-rays showed the vessels satisfactorily outlined. The dog died in twelve hours. Autopsy revealed



FIG. 4. Dog IV. Ten c.c. of 100 per cent sodium iodid injected into the aorta. The renal arteries are well outlined. Note compression of lower abdominal aorta.

bleeding from the mouth and nose, gas in the abdomen with 200 c.c. of bloody fluid, also blood in both pleural cavities. A dissecting retroperitoneal hematoma was present and a large hematoma in the muscle layer of the back. Figure 3 shows the aortic media split and filled with blood clot as well as some blood in the adventitia.

Dog IV. Sodium amytal anesthesia. An 18 gauge needle was inserted into the aorta and 10 c.c. of 100 per cent sodium iodid injected rapidly. Clonic spasms of the lower extremities were present during injection. *X*-ray taken two seconds after injection was completed. (Fig. 4.) The dog died in five hours. Autopsy revealed

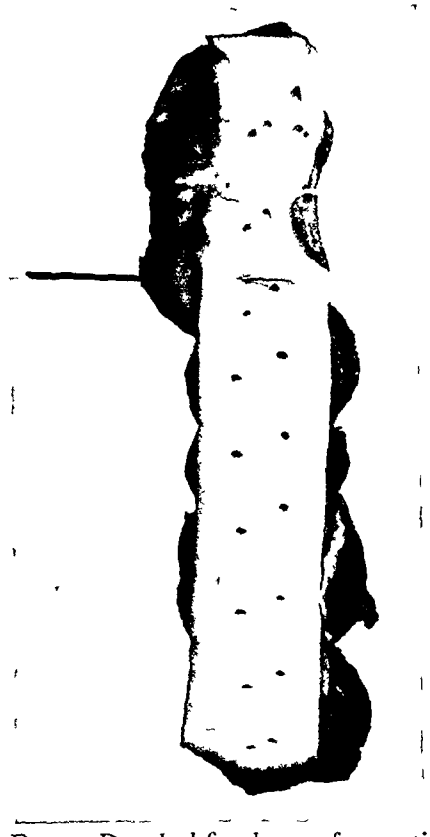


FIG. 5. Dog IV. Dog died five hours after aortic puncture. Shows large hematoma surrounding the aorta which caused death.

bloody fluid in the abdominal and both pleural cavities. There was a dissecting hematoma reaching halfway up the thoracic aorta. (Fig. 5.) The bladder was filled with bloody urine.

Dog V. Sodium amytal anesthesia. A 22 gauge needle was inserted and thought to be in the aorta. Twelve c.c. of skiodan was injected and *x*-ray taken, showing injection *outside* the aorta. One week later 10 c.c. of uroselectan B was injected. *X*-ray showed no arterial visualization. The dog died six weeks later.

Dog VI. Sodium amytal anesthesia. Ten c.c. of skiodan was injected through a 20 gauge needle. *X*-ray showed no arteriograph. The dog died sixty-three days later.

Dog VII. Dial anesthesia. A 20 gauge needle was inserted and 10 c.c. of 100 per cent sodium iodid injected. *X*-ray showed the needle was not in the aorta. The needle was reinserted and 10 c.c. more injected. The

x-ray was fairly satisfactory. The dog died five hours later. Autopsy showed some hemorrhage around the site of the aortic puncture,



FIG. 6. Dog IX. Aorta injected with 2 c.c. of 100 per cent sodium iodid. Left renal artery distinct. Died in four days.

renal glomerular hemorrhage and marked congestion of the liver.

Dog VIII. Sodium amytal anesthesia. Ten c.c. of 50 per cent sodium iodid was injected through a 20 gauge needle into the aorta. Recovery seemed normal. *X*-rays were fairly satisfactory. The dog died several weeks later.

Dog IX. Sodium amytal anesthesia. Two c.c. of 100 per cent sodium iodid was injected through an 18 gauge needle into the aorta. The *x*-ray was satisfactory. (Fig. 6.) The dog died in four days.

Dog X. Sodium amytal anesthesia. Ten c.c. thorotrast injected through a 20 gauge needle into the aorta. The *x*-ray was satisfactory. The same injection was repeated and *x*-ray showed a faint shadow of the large vessels. The dog died several weeks later.

Dog XI. Ether anesthesia. Ten c.c. of thorotrast was injected through a 20 gauge needle into the aorta and *x*-ray taken. No arteriograph. The dog died thirty-six days later. A healed aorta was shown at autopsy. (Fig. 7.)

Dog XII. Ether anesthesia. Ten c.c. of thorotrast injected through a 18 gauge needle. *X*-ray showed faint arterial outlines. Ten c.c. more was injected and one hour later another *x*-ray taken. This showed an accumulation of thorotrast in the liver. The dog died in fourteen hours. Autopsy showed a small amount of blood in the pleural cavity, hemorrhage around and in back of the aorta from the mediastinum, retroperitoneally, lifting up the kidney and filling the pelvis. The aortic puncture was seen, with the intima reddened and infiltrated with blood.

Dog XIII. Ether anesthesia. Five c.c. of 100 per cent sodium iodid was injected through a 20 gauge needle into the aorta. The *x*-rays were fair. The dog had bloody diarrhea and died in nine days. Autopsy showed very little bleeding around the aorta, the aortic puncture seemed closed, the kidneys appeared slightly bluish in color. Microscopic sections of the kidney showed hemorrhage both in the glomeruli and the intertubular spaces.

Dog XIV. Ether anesthesia. Ten c.c. concentrated uroselectan B was injected through a 20 gauge needle. The *x*-rays were negative. The dog recovered and was used one month later as dog XVIII.

Dog XV. Ether anesthesia. Ten c.c. of 42 per cent thorotrast was injected through a 20 gauge needle and *x*-ray taken. It was not satisfactory. The dog died forty-seven days later.

Dog XVI. Ether anesthesia. Twelve c.c. of argo-iodin was injected through a 20 gauge needle into the aorta, followed by severe reaction and death. The *x*-rays were unsatisfactory. Silver chloride was found in the arteries. Figure 8 shows the punctured aorta.

Dog XVII. Ether anesthesia. Forty c.c. of neo-iopax was injected through an 18 gauge needle into the aorta. The *x*-rays were negative. The dog died one month later.

Dog XVIII. Ether anesthesia. Forty-five c.c. of thorotrast was injected through an 18 gauge needle into the aorta. The *x*-rays

were unsatisfactory. The dog died twenty-five days later.

Dogs XIX, XX, XXI. Ether anesthesia.



Fig. 7. Dog xi. Aorta at point of puncture thirty-six days previously. Note healing by fibrosis.



Fig. 8. Dog xvi. Recent puncture of aorta.

Each dog was injected with 10 c.c. of normal saline, using needles of 18, 20, and 22 gauge. Recovery seemed complete and the dogs were apparently normal in every respect. However, the dogs died from four to six weeks later.

COMMENTS

It is surprising with what relative ease the small aorta of a dog can be located and punctured with a needle. Prevention of serious hemorrhage apparently depends partly upon the size and construction of the needle. In most of these dogs a 20 gauge needle with a short bevel was employed, although both larger and smaller needles were used in some cases. The needle must be sufficiently large to allow for the rapid injection of fluid so that the concentration of the contrast media in the large vessels will be adequate to cast a shadow on the *x*-ray film. A larger needle with a long bevel predisposes both to unnecessary injury of the aorta and to postoperative hemorrhage; a smaller needle prevents the proper rate of injection into the aorta. The exposed aorta in dog 11 bled rather profusely following the puncture of the aorta with a 20 gauge needle.

The only solution which gave satisfactory arteriographs was 50 or 100 per cent sodium iodid. Since it required a very concentrated contrast media to cast a shadow of the arteries, because of the circulatory pressure, the injections of skiodan, uroselectan B, and iopax failed to outline the vessels. The arteries were faintly outlined with thorotrast. This thorotrast[22] (thorium dioxid) is absorbed readily by the reticuloendothelial system, particularly of the liver and spleen and is retained in these organs for indefinite periods of time. The council of pharmacy and chemistry of the American Medical

Association has voted against the use of thorotrast for intravenous administration because of its imperfect elimination, its



FIG. 9. (From dos Santos, Lamas and Caldas.) Human aortic arteriograph showing renal arteries and calculus in left kidney.

fairly high alpha-ray activty, the possibility of further increase in its radioactivity by partial conversion to mesothorium and radiothorium, and the possibility of sensitization of tissues to the roentgen rays.[14] It is unfortunate that the safety of this drug must be questioned, since its particular affinity for the liver and spleen have made possible the visualization of these organs never before properly seen with the *x*-ray.[6 9 11 16 23 24]

The spasms noted following the injection of sodium iodid, even when the dog was completely anesthetized, speak for the sudden shock to the tissues. Unquestionably, a sudden hardship is placed on all tissues with which concentrated sodium iodid comes in contact.[11] This is evidenced by the bluish appearance of the kidney following the arterial injection of sodium iodid (dog 11), impressing one with the fact that the renal circulation is temporarily impaired. Normal tissues may overcome this sudden insult but one would be reluctant to subject a damaged organ to this temporary injury.

Legueu, Fey and Truchot[13] have utilized dos Santos' method of aortic artiography in 20 human cases. Four of these manifested rather severe reactions: one from iodism, one nephritis, one hematuric nephritis, and one an alarming case of hyperazotemia with edema, which, however, resulted in recovery. Although they believe this new means of investigation to be of the utmost importance in difficult cases, it still is not entirely without danger.

Paolucci[17] found that 100 per cent sodium iodid injected into the arteries of dogs caused destruction of the intima and necrosis of the media and adventitia in some instances. Chemical changes in muscle fibers were also noted, together with blood clots in the lumen of the artery. He states, however, that 25 per cent sodium iodid and 40 per cent uroselectan caused no damage.

DISCUSSION OF CASES

Five of our dogs which died showed evidence of traumatic hemorrhage due to the aortic puncture itself. Possibly the size of the needle or the multiple punctures of the aorta, may have caused this unusual hemorrhage. Three of the deaths were apparently due to the toxicity of the drug used, as proved by the gross and microscopic appearance of both the kidneys and the liver. The glomerular hemorrhage which extended into some areas of the parenchyma, and the marked congestion of the liver gave evidence of the toxicity of the drug. Only one dog recovered completely and was utilized in another experiment. Twelve dogs died several weeks after the arotic puncture in which no gross or microscopic evidence of damage to the aorta, kidneys, liver or spleen was

demonstrable. Their recovery, following puncture of the aorta and injection of small amounts of various contrast media, was apparently complete, showing no ill effect from this procedure.

In 4 of these 12 dogs the aorta was punctured with an 18 gauge needle, in 6 with a 20 gauge needle, and in 2 with a 22 gauge needle.

Two of these dogs were injected with sodium iodid, 2 with skiodan, 4 with thorotrast, 1 with neo-iopax, and 3 with normal saline. It should be noted that our dosage of sodium iodid was greater per kilogram than dos Santos'; this was probably a factor in the causing of death.

Several autopsies revealed hemorrhage not only from the aortic puncture but in the pleural sac (dogs II, III, IV, and XII), abdominal cavity (dogs I, III, and IV), and occasionally from the mouth and nose and bloody urine in the bladder. Glomerular hemorrhage with congestion of the renal vessels was a common finding in dogs dying shortly after injection (Fig. 2). Although a ragged puncture of the aorta is present for a short time after insertion of the needle (Fig. 8), it apparently heals by fibrosis within thirty-six days (Fig. 7). The aortas of two dogs showed a separation of the media, which was filled with a blood clot (Fig. 3), and some evidence of hemorrhage in the adventitia.

ADVANTAGES AND DANGERS

Although much additional experimental evidence is necessary, it is our impression, from this preliminary study, that the danger of aortic arteriography in dogs is too great to compensate for the information obtained from the *x*-ray film. Other more simple methods of diagnosis are sufficient in almost all conditions in which arteriography is helpful. Because of the danger of hemorrhage and the toxicity of the solutions required for arteriographs, we feel that further experimentation is necessary before the use of this procedure in humans can be advocated.

CONCLUSIONS

1. The aortas of 19 dogs were punctured by inserting a needle at the left costovertebral angle past the vertebra into the aorta. The needles varied in size from 22 to 18 gauge. The aorta of one dog was punctured under direct vision after removal of the abdominal viscera, and an aortic injection was made through an ureteral catheter passed up the femoral artery.

2. Solutions of 50 or 100 per cent sodium iodid, skiodan, uroselectan B, iopax, thorotrast or sterile normal saline were used in different dogs. Concentrated sodium iodid alone gave radiographs which were sufficiently clear for diagnostic purposes.

3. Five dogs died shortly after the aortic injections from traumatic hemorrhage. Three dogs died apparently from the toxicity of the drug. Twelve dogs apparently completely recovered from the operation and examination of the aorta, kidneys, liver and spleen failed to show any damage.

4. Gross and microscopic evidence of damage to the aorta, kidneys and liver was shown in some instances, such as separation of the layers of the aorta, hemorrhage into the renal glomeruli and parenchyma and congestion of the liver.

5. This preliminary report shows the ease with which an aorta may be punctured and injected with solutions. Extreme care must be exercised in the puncturing of the aorta as well as in the selection of the solution used for arteriography.

These experiments were conducted in the Department of Experimental Surgery, and the authors are grateful to Professors Heuer and Sweet for the many courtesies extended.

REFERENCES

1. Allen, E. V. and Camp, J. D. *Proc. of Staff Meetings of Mayo Clinic*, 7: 657 (Nov. 16) 1932, also 8: (Jan. 25) 1933.
2. Allen, E. V. and Camp, J. D. Value of arteriography. *Radiol.*, 22: 678–683, 1934.
[*For Remainder of References see p.* 290.]

SIMPLIFIED LOCAL VAGINAL HYSTERECTOMY

INDICATIONS AND CONTRAINDICATIONS

A. SAMPOLINSKI, M.D., F.A.C.S.

Associate Clinical Professor of Surgery, Loyola University; Senior Surgeon, St. Mary of Nazareth Hospital

CHICAGO, ILL.

OVER three hundred years ago Cruce did the first vaginal hysterectomy apparently for a carcinoma of the uterus. The operation was performed without following any systematic procedure and in the majority of cases the uterus was prolapsed as well as carcinomatous.

Sauter began systematic operation, when he successfully extirpated the uterus in situ by the vaginal route. Recamier also accomplished the same purpose after ligating the lower broad ligaments. The work of Sauter and Recamier was followed by Billroth, Czerny, Schroder, Rean, Segond, Richlos and Doyen and was performed regularly until 1830.

In 1830 Freund's success with abdominal hysterectomy caused a change in the attitude and only forty years ago Czerny restored the recognition of the importance of vaginal hysterectomy, nearly all his operations being performed for either prolapse or carcinoma.

In America the first vaginal hysterectomy apparently was done in 1829 by J. Collins Warren. In 1882 Fenger gave a detailed description of vaginal hysterectomy which was done only in cases of prolapse, inversion and carcinoma case reports by various operators then were published.

Vaginal hysterectomy is performed more frequently in Europe than in the United States. Dr. Van Grover, of the Krakow University, Poland, stated that the majority of hysterectomies in Europe are performed vaginally for two reasons:

1. It is more economical because the operation is performed under spinal anesthesia, which is very cheap.

2. Recovery after the operation is much faster, not requiring as long a hospitalization as is necessary in abdominal hysterectomy, and therefore is more economical for the indigent patients.

Recently in the United States, vaginal hysterectomy is again coming more into favor because its mortality rate is one-third that of abdominal hysterectomy, due to less trauma to the viscera; and, postoperative shock is almost nil, while death following abdominal hysterectomy, as a rule, is from shock or paralytic ileus or both, caused by excessive manipulation of the bowels, which stimulates the sensitive sympathetic nervous system.

The least complication is encountered in cases of procidentia uteri, where the tissues are not friable. The danger of postoperative hemorrhage is not as great as in other pathological cases, therefore the uterus can be removed easily, but the success of the operation for prolapse depends upon the wide mobilization of the bladder and rectum. Dr. Charles H. Mayo recommends suturing the stumps of the broad ligaments.

Dr. Channing Barrett simplifies this technique, especially when the stumps of the broad ligaments are short and it is not feasible to unite them. He supports the angle of the vagina by suturing the anterior and posterior vaginal wall on each side to the corresponding stumps, so that the procedure gives good support to the bladder and anterior portion of the rectum.

INDICATIONS FOR VAGINAL HYSTERECTOMY

1. Complete prolapse of the uterus, especially after the menopause
2. In cases of cancer of the fundus, where the growth is still localized
3. In epithelioma of the cervix not involving the vaginal wall
4. Small fibroid, bleeding uterus

5. Infected uterus
6. Carcinoma in old and obese patients, where the abdominal operation is contraindicated, and in those in whom the corpus uteri is not too large, without evidence of an invasion to the surrounding tissues nor of an infection of the inguinal lymph glands.

CONTRAINDICATIONS

1. Extensive adhesions of the uterus
2. Advanced disease of the adnexa
3. Too large a uterus

Dr. Channing Barrett performed more than 2000 vaginal hysterectomies in forty years of practice, prefers the vaginal route in all cases where such an operation can reasonably be accomplished.

In cases of cancer of the cervix, where the disease is far advanced and where a radical extirpation by the abdominal or vaginal route is impossible, the best treatment aside from the radium treatment, is thorough cauterization as recommended by Drs. Burnes and Percy, of California.

Dr. A. J. Ochsner simplified cauterization of the uterine cavity by using an ordinary red-hot plumber's iron, heated over a gas stove. An iodoform gauze, covered with glycerine, is then inserted into the uterus and a retention catheter is introduced into the bladder. This type of operation not only protects the vaginal wall from invasion, but after the eschar which forms during the process of healing, separates, the connective tissue contracts the organ and is likely to stop the progress of the disease. Many of these patients improve to such an extent that the surgeon is prone to doubt his diagnosis because some of these inoperable and hopeless cases may be operated later, or if they refuse an operation, they continue to live for a period of several years.

If there is the slightest suspicion of malignancy, especially in women at the menopause or thereafter, hysterectomy should be performed at once. Removal of a portion of the tissues for microscopic examination or diagnostic curettage should be condemned, unless frozen section examination is made immediately and the patient is prepared for hysterectomy or radium treatment, should malignant changes be present.

Due to the speedy recovery and low mortality after vaginal hysterectomy, many articles on the improved technique of this procedure have been published recently.

The technique I am describing is Dr. Channing Barrett's. It is so simple that any surgeon can perform a vaginal hysterectomy with a good result and a low mortality rate.

PREOPERATIVE PROCEDURES

First, by manual examination, determine the size, consistency and mobility of the uterus and whether or not it has undergone malignant changes.

On the day before the operation the patient is given a potassium permanganate (1:500) or lysol douche; then the routine preoperative orders.

The blood pressure and coagulability should be ascertained, in addition to the routine blood and urine examination.

The night before the operation the patient is given phenobarbital grains 3 which permits quiet rest through the night.

At 6:00 A.M. the patient receives phenobarbital grains 3 and half an hour before the operation a hypodermic injection of morphine sulphate grains ¼ and atropin, grain 1/100 so when brought to the operating room she is in an analgesic stage.

TECHNIQUE

The patient is placed in the extreme lithotomy position the hips projecting about 3 inches over the edge of the table.

Immediately after the patient has been anesthetized, the vagina should be thoroughly washed with soap and water, and then irrigated with a 1:1000 solution of bichloride of mercury and 50 per cent alcohol.

A heavy weight retractor is used to retract the posterior vaginal wall.

Two assistants, one with his right hand over the patient's left leg and another with his left hand over the patient's right leg, hold the ribbon retractor, to separate the lateral vaginal walls and expose the cervical portion of the uterus.

The cervix is caught with the heavy volsellum forceps and drawn forward. The position and consistency of the uterus is determine with a uterine sound. The cervix and the vagina is swabbed with tincture of iodine and the excess washed off with alcohol on a sponge.

With 1 per cent novocaine infiltrate the cervix all around ¼ inch below the reflection of bladder over the cervical wall, which should be determined by a sound. Make a circular incision around the cervix, about ¾ to 1 inch from its edge. Strip the anterior portion of the vaginal wall with gauze, manipulating it so that the bladder wall will be pushed upward. Using gauze the posterior vaginal wall is stripped as far as possible, to prevent injuring the rectum.

If the patient is under phenobarbital and morphine analgesia, the stripping of the anterior and posterior vaginal walls could be done very easily and painlessly.

If the patient complains of pain a novocaine infiltration (under the elevated portion of vaginal wall) can be done very easily.

The peritoneal fold is injected with 1 per cent novocaine and an incision is made into the posterior peritoneal fold of the cul de sac of Douglas spreading the peritoneum with dull scissors and the index fingers.

The anterior peritoneal fold is then recognized and injected with 1 per cent novocaine, incised, and the peritoneum spread with dull scissors and the index fingers, care being taken that the bladder is not injured. The best guide for the prevention of injury is to introduce a sound into the bladder and cut the peritoneal fold posterior to it. The index finger of the right hand is inserted into the peritoneal sac, the bladder wall and the intestines pushed away from the operative field and the adnexa examined.

The tenaculum forceps are pulled forward and to the patient's left, 1 per cent novocaine is injected and heavy hemostatic forceps applied over the right uterine artery close to uterus to avoid the right ureter, and tightened securely so that it will not slip off; then the uterine artery is severed, cutting away from the forceps next to the uterus so that the forceps will not slip off the tissue.

The same thing is done reversely, on the left side of the uterus. One per cent novocaine is injected and then the cervix is amputated as high as possible. Cutting the cervix high is a very important procedure in vaginal hysterectomy, because the infected cervix is eliminated from the operating field and helps to rotate the uterus.

After the cervix is severed, if the uterine canal is enlarged and there is evidence of infection, a strip of iodoform gauze saturated with iodine can be pushed into the remaining portion of the uterine canal and the canal closed with a stitch, burying the iodoform gauze in the uterus, and thus protecting the abdominal contents from possible infection and peritonitis.

The bladder wall is pushed away from the operating field and the uterine body grasped with heavy tenaculum forceps, with another tenaculum forceps advancing slowly and pulling the body of the uterus forward until the entire uterus reverses; that is, the cervical portion of the uterus will point upwards toward the abdominal cavity and the body of the uterus will fall forward into the vagina.

If the adnexa are pathologic and are to be removed, a sponge is placed in the culdesac of Douglas to prevent protrusion of the intestines, the body of the uterus pulled forward and to the patient's left and strong forceps applied from above downward including the round and the upper portion of the broad ligament and right ovarian vessels. The second forceps may be applied over the lower end of the broad ligament. After the right adnexa are cut free, the left can be secured more easily in the same manner.

The round ligament and the upper portion of the broad ligament and ovarian artery on right side are ligated with chromic catgut; then the same ligation is done on the left side. The right uterine artery is ligated with chromic catgut, transfixing it; then the left uterine artery is ligated. All the ligatures on the ovarian and uterine arteries should be done quite high from the forceps, to prevent the ligature from slipping.

The wound on the right side is sutured with the chromic catgut, stitching through the anterior portion of the vaginal wall, the peritoneum, the round and broad ligaments, and then through the posterior peritoneum and the posterior portion of the vaginal wall, so that the stump of the broad and round ligaments will lie at the angle of the vagina. The same procedure is followed on the left side. This gives ligamentary suspension to the upper part of the vagina, preventing it from prolapsing.

The anterior wall is then sutured with the peritoneum; then the posterior peritoneum and posterior vaginal wall. It may require a few similar stitches, depending on the size of the wound, leaving a small opening in the center for the iodoform gauze drain.

Repair of a cystocele or a rectocele, or perineorrhaphy, if required is usually performed at the same time; but if the patient can not tolerate so much surgery at one time, then the repair can be done seven to ten days later, under a gas anesthesia. Before the patient leaves the operating room a retention catheter is inserted into the bladder.

REFERENCES

Taylor, J. C. Vaginal Hysterectomy. *N. Y. M. J.*, 105: 53–56, 1916.

Alvarez, D. C. Valor de la histerectomia vaginal en el tratamiento del cancer uterine. *Arch. de Gynec., Obst. y Pediat.*, 29: 474, 1916.

Webster, J. C. The scope of vaginal section. *Wisc. M. J.*, 2: 714–718, 1903–4.

Boyd, G. M. Inversion of the uterus. *A. J. Obst.*, 80: 161, 1919.

Strassman, P. The present position of vaginal operations in relation to the uterus and its adnexa. *Brit. M. J.*, 2: 983–990, 1911.

Morsley, J. S. Vaginal hysterectomy for cancer of the uterus. *Virginia M. Monthly* (Dec.) 1931.

Ochsner, A. J. Surgery. Page 540–585.

Cuneo, B., and Picot, G. Technique de l'hysterectomie perineale pour cancer du col de l'uterus. *J. de Chir.*, 17: 193, 1921.

Hartmann, H. Technique de l'hysterectomie perineale pour cancer du col de l'uterus. *Gyn. et Obstet.*, 3: 350, 1921.

Phaneuf, L. E. Two cases of early carcinoma of the uterus treated by vaginal panhysterectomy. *Boston M. & S. J.*, 187: 115, 1922.

SINGLE INCISION, TRANSABDOMINAL, EXTRAPERITONEAL APPROACH TO LUMBAR GANGLIA

CLARENCE E. REES, M.D., F.A.C.S.

Chief, Division of Surgery, Rees-Stealy Clinic; Surgical Staff, Mercy and San Diego County General Hospitals

SAN DIEGO, CALIF.

THE selection of an incision through which to reach a given site of operation requires the careful consideration of three factors all of which are important to both the patient and the surgeon: (1) there must be adequate exposure so that the necessary procedure may be performed with dispatch and precision; (2) there must be a minimal destruction of important structures so that a reconstruction of the wound with unimpaired functional results is assured; (3) there must be minimal manipulation of structures the exposure of which might cause later complications.

The diverse opinions of qualified surgeons as to the proper approach for operations on the lumbar sympathetic ganglia indicate that a completely satisfactory approach to this field has not been described. If operations on these structures were always unilateral the problem would be more simple but since the abnormal conditions which involve the structures influenced by these ganglia are frequently bilateral it becomes necessary to attack the ganglia on each side at a single operation.

We have avoided the lumbar incision described by Royle[1] for operations on the lumbar ganglia because we observed that the exposure thus obtained did not give as free an access to the ganglia as could be obtained by the transperitoneal approach. An incision from the side gives a deep operative field with definite limitation of extension in the posterior limb of the incision. As a result, access to the lower ganglia is sometimes difficult since these ganglia follow the spinal contour, and bleeding caused by injury to the veins which overlie the ganglia on the right is more difficult to control than when exposure is more adequate. Furthermore, lumbar incisions require separate preparation of two operative fields and alteration of the position of the patient when changing from one side to the other, all of which lengthens the time of surgery and anesthesia.

The transperitoneal approach through a midline incision described by Adson[2] gives ample exposure and, if necessary, can be extended in either limb in the line of the structures being operated. However, in spite of extreme care in handling the intestines, we have had a great deal of postoperative discomfort, as ileus, etc., in a large percentage of cases in which this approach was used. In 3 cases intestinal obstruction which required operation for relief developed. In 2 of these cases the obstruction occurred before the patient left the hospital and in the third case, several months later. In this last case, operative intervention which was performed elsewhere, resulted fatally. In all 3 cases the obstruction was caused by adhesion of the small intestine to the posterior peritoneal incision, in one on the right side and in 2 cases on the left side. A procedure which carries this hazard should be eliminated if possible.

An anterior extraperitoneal approach to these ganglia has been described recently.[3] This is a lateral approach through a muscle splitting incision, which again necessitates two incisions with resulting change of

position of the patient and does not permit extension of the incision in the line of the ganglia.

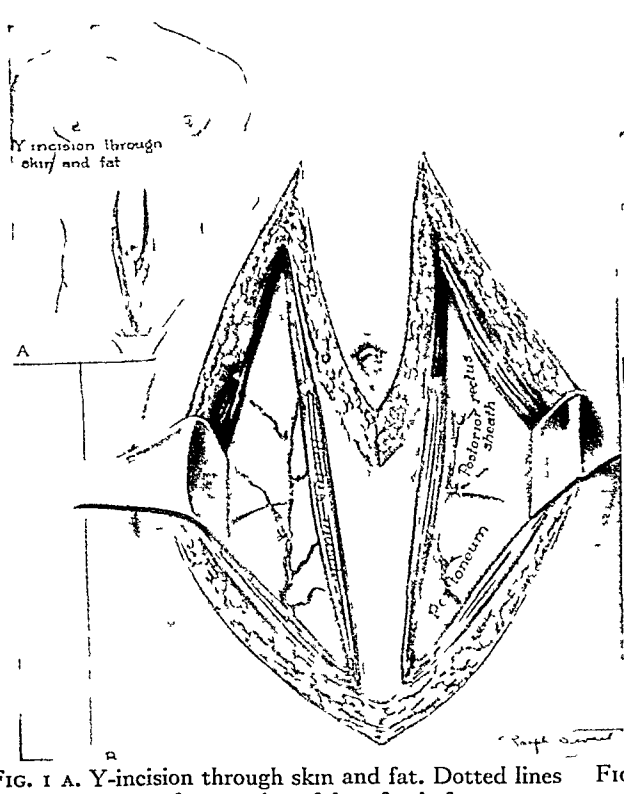


Fig. 1 A. Y-incision through skin and fat. Dotted lines indicate areas of separation of deep fascia from rectus sheaths. If operation is to be unilateral, the incision swings only to the side of the umbilicus on which the operation is to be performed. B. Incision of rectus sheath and rectus muscle on each side exposing the peritoneum in the lower part and the posterior sheath in the upper part of the incision. If the operation is unilateral, the rectus sheath on that side only is opened.

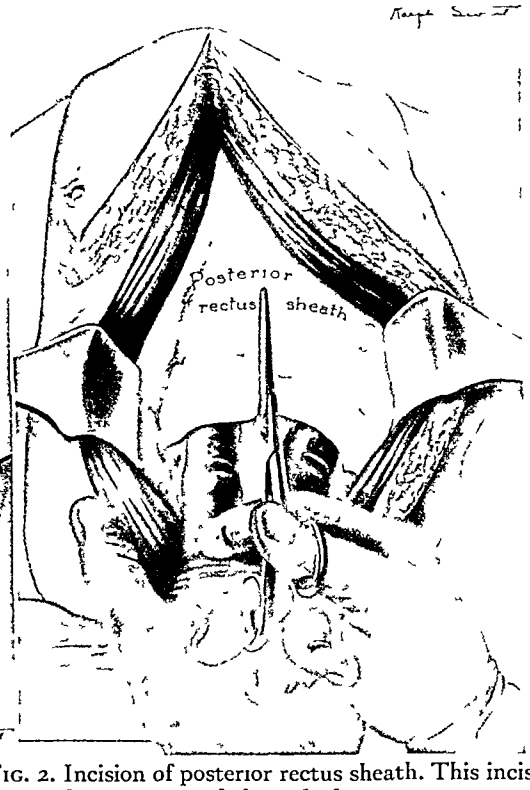


Fig. 2. Incision of posterior rectus sheath. This incision does not extend through the peritoneum.

Because of the disadvantages of these previously described incisions for this type of surgery, we have developed an incision which gives an exposure equal to that of the transperitoneal approach and eliminates entirely the direct handling of the intestines. It is a single skin incision requiring but one preparation and its closure is effected in a manner which, for a number of years, has been found satisfactory for lower abdominal incisions. This approach consists of a Y incision through the skin and fat and a longitudinal incision through each rectus muscle to, but not through, the peritoneum. This combination makes a bilateral incision through the deeper structures which permits the exposure of the ganglionated chains in a manner that avoids the less desirable features of the other methods of approach.

The type of anesthesia is optional with the surgeon but it should be adequate for surgical relaxation. Surgical preparation of the abdomen is made from the nipples to the thighs.

A low midline incision through the skin and fat is made from the symphysis pubis to one inch below the umbilicus. At this point the incision is developed into a Y with limbs extending upward on each side of the umbilicus over the inner one-third of the rectus muscle to a point midway between the xyphoid and the umbilicus. (Fig. 1 A.) In the lower part of the incision the deep layer of superficial fascia is separated from the inner halves of the rectus sheaths on each side to a point that is in the same lateral plane as the upper limbs of the incision. A longitudinal incision is made in each rectus sheath so

that one-third of the muscle lies medial and two-thirds lateral to each incision. The rectus muscle is then incised in this same plane thus carrying the exposure down to the posterior sheath of the rectus in the upper three-fourths and to the peritoneum in the lower one-fourth of the incision. (Fig. 1 B.) The deep epigastric artery which lies on the posterior sheath and on the peritoneum is then in view and any bleeding vessels are ligated. The posterior sheath is separated from the peritoneum by inserting the finger between these structures lateral to the outer border of the rectus muscle. This separation is carried inward toward the midline by digital dissection. The posterior sheath, not the peritoneum, is then incised lateral to the deep epigastric artery leaving the artery on the medial side of the incision. (Fig. 3.) This method of separation of the peritoneum from the posterior sheath is one of the important points of this operation. If such separation is started in the line of incision, the peritoneum is very likely to be opened, whereas, if the line of cleavage is entered lateral to the rectus muscle, thus carrying the dissection inward, this separation is accomplished easily.



Fig. 3. Separation of posterior rectus sheath from peritoneum.



Fig 4. Retraction of the peritoneum with its contents, left side

The patient is then placed in the low Trendelenburg position.

The peritoneum which has been exposed by incision of the posterior sheath is separated laterally from the abdominal fascia (Fig. 4) and, with its abdominal contents, is retracted gently toward the opposite side until, on the left the aorta and iliac vessels, and on the right the vena cava and iliac vessels are exposed. At this point the peritoneum is held by deep retractors, or preferably, the assistant's hand, over gauze and the operation of choice on the sympathetic chains is performed. (Fig. 5.)

Accidental opening of the peritoneum does not carry the hazard involved in a similar approach in cases of operations upon infected ureters. Such an opening occurring during the extraperitoneal approach to the ganglia may be closed at once or after completion of the operation depending upon whether or not retraction tends to increase the size of the rent.

Closure is effected in layers using single continuous chromic catgut sutures in the posterior sheath and in the muscle, and single interrupted chromic catgut sutures with simple square knots in the anterior sheath. This latter suture is reinforced with figure-of-eight silkworm retention sutures. In the branching limbs of the incision the usual figure-of-eight sutures are used. In the single limb of the incision the lower loops of these sutures alternate on opposite sides of the fascial incisions, that is, one suture passes through skin and fat and loops through the right rectus sheath to exit through the fat and skin on the other side, while the next suture passes through the skin and fat and loops the left rectus sheath to emerge through to the fat and skin. One end of each superficial loop of the figure-of-eight sutures, after emerging from the skin is passed again through the margins of the skin incision so that when the tie is made it is to one side of the skin incision. This leaves two loops of silkworm gut above the skin, one on each side. Rubber tubing is then passed under these loops on each side and the sutures are tied over these tubes so that the dead space within the incision is obliterated. The skin is closed with clips.

CONCLUSIONS

A transabdominal, extraperitoneal approach to the lumbar ganglia is described which we have found superior to other methods of approach in that adequate exposure of the ganglia on both sides is obtained and direct handling of the intestines is avoided.

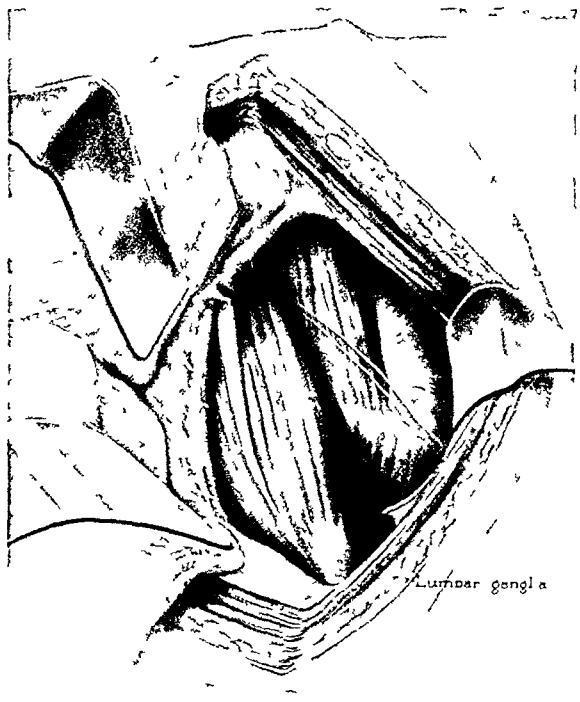


Fig. 5. Peritoneum retracted and the lower lumbar ganglia exposed, left side.

REFERENCES

1. Royle, Norman D. The treatment of spastic paralysis by sympathetic ramisection. *Surg. Gynec. Obst.*, 39 701–720 (Dec.) 1924.
2. Adson, A W. and Brown, G. E. The treatment of Raynaud's disease by resection of the upper thoracic and lumbar sympathetic ganglia and trunks. *Surg. Gynec. Obst.*, 48. 577–603 (Aug.) 1929.
3. Flothow, P. G. Anterior extraperitoneal approach to the lumbar sympathetic nerves *Am. J. Surg.*, 29. 23–25 (July) 1935.

LOW MORTALITY OF EARLY OPERATION FOR PERFORATED GASTRIC AND DUODENAL ULCER

BENJAMIN T. TILTON, M.D., F.A.C.S.

Director of Surgery, Broad Street Hospital

NEW YORK CITY

PROMPT surgical intervention in the face of sudden perforation of a gastric or duodenal ulcer has been the established practice for many years and countless lives have been saved which would have been sacrificed by delay and symptomatic treatment. But even at the present time delay still contributes to maintaining the mortality of this serious complication of ulcer at a much higher point than it should be. In some cases delay is excusable; in others it is not. Early diagnosis is of course indispensable and in most cases should be easily made from the characteristic and dramatic onset of the symptoms and the objective findings. In a few hours the diagnosis may be more difficult on account of the subsidence of the early symptoms and a resulting latent period before the development of peritonitis. After peritonitis is established, its point of origin cannot be diagnosed with the same accuracy as at the onset of the perforation, and hence the site of the abdominal incision is not always properly selected. Distance from a surgical center, requiring long transport and delayed consent for operation, may account for the sacrifice of many precious hours between perforation and operation. It is the number of these intervening hours that is the most important factor in the mortality rate. I think that it can truthfully be stated that with proper surgical technique and judgment and the absence of unexpected complications, the mortality of perforated gastric or duodenal ulcer should be practically zero if the patient comes to the operating table within twelve hours after perforation. After twelve hours delay becomes increasingly more serious for the prognosis; after twenty-four hours the mortality mounts still more rapidly. After thirty-six hours operation is rarely successful and it is probably better judgment to abstain from operation and rely on natural reparative processes which, in isolated instances, have been known to bring recovery. Apart from delay, poor surgical judgment and technique will of course always keep up the general mortality rate even in early cases.

In 52 cases operated at the Broad Street Hospital during the past five years I have had the opportunity of observing a practical demonstration of the excellent results that follow when the patient with a perforated gastric or duodenal ulcer is brought promptly to the surgeon. Delay has been at a minimum in these cases, as the hospital is situated in a very condensed area which is populated only during the day and chiefly by office personnel. Intelligence above the average on the part of this temporary day population and very short transportation to a hospital, equipped for and accustomed to sudden demands of emergency cases give these cases of perforation their best chance. In this series of cases the average time elapsed between the onset of the acute signs of perforation and the start of the operation was only six hours.

Study of the records of these cases brings out other factors of interest, some of which undoubtedly help to explain the absence of mortality of the series traceable to the perforated ulcer or the operation.

Age. The youngest was twenty years, the oldest fifty-three years with the average

thirty-six years; patients of early and middle life, a favorable period for operation and repair.

Sex. There were 50 males and only 2 females. This excessive preponderance of males in the series is due, not only to the greater susceptibility to perforation of males in general but also to the fact that the district in which the hospital is located has a much larger daily male population. This predominance of males probably does not influence the mortality following operation.

Occupation. In 50 cases in which the occupation was given there were 33 of the sedentary class, including clerks, stenographers, telegraph operators, bookkeepers, salesmen, etc. There were 17 whose work was more strenuous, such as porters, deck hands, elevator operators, restaurant employees, etc. As already stated the higher average of intelligence in the majority of the cases as compared with the tenement classes insures prompt resort to medical aid and early consent to operation.

Site of Perforation. In 46 cases the operative records stated that the perforation was on the anterior surface of the stomach or duodenum at or near the pylorus. In one case it was on the anterior wall halfway between the pylorus and cardia. In 3 cases it was on the posterior wall, one being at the site of a posterior gastro-enterostomy. In 2 cases the site of perforation was not recorded. In 23 cases the site of the ulcer was stated to be prepyloric, in 18 cases postpyloric and in 5 cases the general term "pyloric region" was used. These figures support other statistics and are probably more striking in their high percentage of perforations near the pylorus on account of the excessive male element in the series. From my experience I am inclined to believe that postpyloric perforations are much more common, in males at least, than prepyloric. It is possible that through inaccuracy in observation a postpyloric perforation may be recorded as prepyloric. Such a mistake is easily made unless one pays special attention to the differentiation.

The operative procedure employed in this series was, with slight variations, uniform. Exposure of the pyloric region was followed by aspiration of the fluid contents of the peritoneal cavity and suture of the perforation. One or more layers of purse string or Lembert suture, usually of chromic catgut, were used to close and infold the small perforation. Suture of omentum over the infolding suture is desirable. The methods of drainage varied and were as follows:

1. A strip of rubber tissue drain to the area of suture;
2. Drainage of Morrison's pouch;
3. Drainage of pelvis through a small secondary incision above the pubis or in the right lower quadrant;
4. Rubber tissue drain to the sutured peritoneum only;
5. No drainage.

In my opinion intraperitoneal drainage is not necessary or desirable in the early cases. Rubber tissue drainage down to the sutured peritoneum is my practice in all cases, on account of possible infection of the subcutaneous tissues from the peritoneal exudate. For this reason I approximate the skin and subcutaneous tissues with interrupted silkworm gut or dermal, and do not use coaptation sutures for the skin edges. In this way infection of the wound and its unfortunate sequelae can be avoided.

In no cases was a gastro-enterostomy or other secondary operation performed. In my opinion such prolongation of the operation is most unwise. The main object should be to save the patient's life and therefore "get in and out" as quickly as possible. It is far better to postpone to a later time any further operative procedure when a proper choice of operation can be made, based on *x*-ray or other studies. In many cases the ulcer can be healed by postoperative medical treatment. For this reason these patients should always be referred to the gastro-

enterological department of the hospital as soon as they have recovered from the operation.

There is a great tendency in the European surgical clinics, notably the German and the Austrian, to perform gastric resection in place of simple suture of the perforation. Gastro-enterostomy has been largely discarded by them in these cases just as it has been in the non-perforated ulcers. Some clinics have recorded a mortality rate as low as 5 per cent in selected cases of gastric resection, i.e., in those operated within twelve hours and whose general condition is satisfactory. This radical method is justified by these surgeons on the ground that the perforated ulcer and possibly one or more secondary ulcers are removed by the resection and thus a later operation or prolonged medical treatment is avoided. Furthermore, they claim that their enormous experience in gastric resection in all types of ulcers has so perfected their technique, that the operation can be done very rapidly, i.e., in forty-five minutes, and hence with little additional shock. In spite of these arguments I feel that a mortality of practically zero in cases operated early by simple suture can never be equalled by the method of gastric resection, certainly not if it becomes routine among surgeons with their varying proficiency in performing the radical operation. Another consideration is that many, if not most of the cases operated by simple suture will never require the secondary radical operation. It seems hardly fair to subject all cases to the risk of a resection when only a moderate percentage of them might need it at a future time. In trying to rid the patient of his ulcer at the time of the emergency operation the surgeon is attempting too much and the risk involved in changing from a no mortality procedure to a hazardous radical one is not justifiable.

Most of the cases in this series ran a smooth postoperative course. The various complications were as follows:

Infection of wound 12 cases.
Bronchopneumonia 6 cases.
Femoral phlebitis 1 case.
Cerebral embolism 1 case.
Bilateral suppurative parotitis 1 case.

There was only one death in the series and that was caused by cerebral embolism. This occurred on the ninth day in a patient forty-six years old who had entirely recovered from the operation and was about ready to get out of bed. All the other cases with postoperative complications recovered completely. Were it not for the unforeseen and unavoidable death from cerebral embolism this series of 52 cases would have had a mortality of Zero. As already stated this should be the case in any series in which the patient is operated within twelve hours under favorable conditions and unavoidable complications do not occur.

I am indebted to the chiefs of the other surgical divisions of the hospital for the privilege of including their cases in this report.

SUMMARY

1. Prompt surgical intervention is vital in cases of perforated gastric and duodenal ulcer.

2. If the period between perforation and operation is twelve hours or less, the mortality should be practically nil under favorable conditions and in the absence of unavoidable complications. In this series of cases the elapsed time averaged only six hours.

3. In about 90 per cent of the cases the perforation was on the anterior wall.

4. Operation should consist of simple closure with chromic catgut and suture of the omentum over the site of perforation. Immediate radical operation such as partial gastrectomy is unjustifiable.

5. Intraperitoneal drainage is not necessary or desirable in the early cases.

6. There was only one death in this series and that was due to an unavoidable complication, cerebral embolism on the ninth day.

DELAYED OPERATION IN ACUTE CHOLECYSTITIS*

REPORT OF 134 OPERATIONS ON THE BILIARY TRACT, COVERING A PERIOD OF FIVE YEARS

HUGH L. BASS, M.D., AND CLARENCE E. BIRD, M.D.

LOUISVILLE, KENTUCKY

THIS article deals with the immediate results of surgical treatment of diseases of the biliary system as performed in the Louisville City Hospital during the five year period between January 1, 1930, and January 1, 1935. The operations were performed on a general surgical service by twenty-five different surgeons. Although the patients belonged to the less fortunate groups of individuals in the community, it cannot be said that they were less favorable risks, from a surgical standpoint, than the average seen in practice.

During the five year period, 142 operations were performed on patients in whom preoperative diagnoses of diseases of the biliary tract had been made. In 6 instances the preoperative diagnoses were found to be erroneous and were corrected at operation as follows: in 2 cases, carcinoma of the head of the pancreas; in one each, cirrhosis of the liver, catarrhal jaundice, "enlarged liver," and retroperitoneal lymphosarcoma. In 2 other cases no disease was found in the biliary system or elsewhere. These latter 8 cases have been removed from the series, and only the remaining 134, in which actual diseases of the biliary tract were verified either at the time of operation or in the pathological laboratory, are considered in the remainder of the report.

The distribution of the cases was as follows: females 105, males 29; white 105, colored 29. The youngest patient was seventeen years old, and the oldest sixty-eight; average 42.5 years. The mean duration of symptoms was three years and five months. Eighty-four of the females had an average of 4.6 pregnancies, 4 were nulliparous, and in 17 cases no information as to parity was available. In 23 of the 134 histories, the statement was found that the patient had had typhoid fever, but in many instances there was no information one way or the other. Sixty-five per cent of the patients were obese, 24 per cent average in weight, and 5 per cent undernourished. No statement as to the physical type was found in 8 of the histories. Nine of the patients had been subjected previously to operations upon the biliary tract, which were, with one exception, cholecystostomies.

Cholecystograms were made in 75 per cent of the cases, mostly by the oral method. Whenever the roentgenologist made a positive diagnosis of cholecystic disease by this method, the findings at operation were confirmatory. On 4 occasions when the cholecystograms were read as normal the operators discovered chronic cholecystitis without stones, and in one case, chronic cholecystitis with calculi in the gall bladder.

Chronic cholecystitis with stones in the gall bladder (in 8 of these cases there were also stones in the common bile duct)	73	
Chronic cholecystitis without stones (in one of the cases there was also a stricture of the common bile duct)	49	
Total cases with chronic cholecystitis		122
Acute cholecystitis with stones in the gall bladder (in 3 of these cases there were also stones in the common bile duct, and in 4 cases the gall bladder was ruptured)	6	
Acute cholecystitis without stones	4	
Total cases with acute cholecystitis		10
Carcinoma of the gall bladder		2
Total cases		134

The operative procedures were divided as follows: cholecystectomies 117, cholecystostomies 12, choledochostomies 31. Obstruction of the common duct was found in 12 cases in which the duct was explored. Stones caused the obstruction in 11 instances; in one case it was due to the formation of scar tissue as the result of a previous operation. The exact nature of

* From the Department of Surgery, Louisville City Hospital, and the University of Louisville School of Medicine.

this operation is unknown but the gall bladder was not removed. The average stay in the hospital following the 134 operations was 19.9 days.

The pathologic changes were as shown on page 241.

The hospital mortality rate was 4.5 per cent. Abstracts of the histories of the 6 patients who died, accompanied by comments on their management are recorded.

Case 1. A colored porter, aged forty-seven years, complained that two days previously he had onset of pain localized near the umbilicus for the first two to three hours, after which it moved over to the region just beneath the right costal margin. He vomited once, took magnesium sulphate, and vomited again. The pain became progressively worse and did not radiate. He had no previous attacks of abdominal pain. The patient had been subject to bronchial asthma for fifteen years and had had typhoid fever.

Examination showed the patient to be in much discomfort, temperature 101°F., pulse rate 120 and respirations 24. There was muscle spasm over a tender mass below the right costal margin. His white blood count was 15,000 cells with 89 per cent polymorphonuclear leucocytes. His urine was normal.

Emergency operation under spinal anesthesia was done. The gall bladder was found to be distended, discolored and apparently gangrenous in spots. It contained about 40 cm. of bile stained fluid and no stones. A catheter was inverted into the fundus; cigarette drain left in the wound.

Postoperative course was stormy. The temperature rose to 104°F., the pulse to 136, the abdomen became distended, the patient became dyspnoeic, irrational and comatose, and died on the second postoperative day. Permission for a postmortem examination was refused, but the causes of death were considered to be acute generalized sepsis, paralytic ileus and hepatic insufficiency.

Comment: Cases of this nature question the advisability of operation in the acute stage of gall-bladder disease. The authors believe that this patient should have been left quiet for ten days to three weeks before operation. During such an interval the daily administration of glucose would have fortified the liver against insufficiency and the infection would almost certainly have receded into a subacute or chronic localized state.

The record indicates that the diagnosis was indefinite and that acute inflammation in a superiorly placed appendix was suspected. Under these circumstances exploration was indicated, but unless perforation was imminent or acute pancreatitis had been present we believe that the gall bladder should have been left alone and that the abdomen should have been closed without drainage. In other words, having determined that the appendix was innocent and that the gall bladder was simply acutely inflamed, the patient would have stood a better chance for recovery if the removal of the gall bladder had been left for a second stage when there was less infection and when the preparation of the patient had been adequate perhaps two or three weeks later.

The operative note in this case states that the operator considered the wall of the gall bladder to be "gangrenous in spots." It is our opinion that very few indeed of these gall bladders will actually rupture if left alone. In a questionable case the omentum should be wrapped around the gall bladder but unless perforation is obviously about to occur we believe neither a cholecystostomy or a cholecystectomy should be performed.

Case 11. A white widow, aged sixty-six, was admitted to the medical ward complaining of pain in the right upper quadrant of the abdomen. At irregular intervals for eight to ten years she had had severe pain below the right costal margin with radiation to both scapula and intolerance to fried foods, but she never had any jaundice. She had seven pregnancies. Onset of the present attack was the day previous to admission.

Patient very obese and quite ill. Temperature 100.3°F., pulse rate 105, respirations 30. Marked muscle spasm and tenderness were elicited just below the right costal margin. The blood count revealed 7,650 leucocytes with polymorphonuclear leucocytes 65 per cent, erythrocytes 3,580,000, hemoglobin 75 per cent. The urine was normal. Icterus index was 5 and non-protein nitrogen 31.5 milligrams.

The patient improved on rest in bed so that the following examinations could be made.

A film of the chest showed considerable cardiac enlargement and cloudiness throughout the left lung field with mottling on the right. Left axis deviation was demonstrated by an electrocardiogram. A gastrointestinal series indicated 20 per cent retention of barium in the stomach at six hours; no organic change was demonstrated, however. The gall bladder was not visualized in cholecystograms.

Glucose was administered intravenously for two days before operation. A contracted, chronically thickened gall bladder which contained a small amount of pus and one stone was removed. The pathologic diagnosis was chronic cholecystitis with extensive fibrosis and cholelithiasis.

The patient never rallied and died on the following day with a temperature of 106°F., pulse of 120, respirations 28. The clinical impression was hepatic insufficiency.

Comment: In evaluating this case it would be desirable to know more of the details of the operation itself than appear on the chart. However, there is no reason to believe that there was undue trauma, spillage of infected material into the peritoneal cavity or that there were difficulties with the anesthesia. It seems likely that this patient falls into that class of patients with chronic liver damage who would be greatly fortified by prolonged treatment with glucose. It will be noticed that in spite of the fact that she was studied on the wards for two weeks, glucose was administered for only two days preoperatively, an entirely too short period of preparation for any patient with cholecystitis.

Case III. A white widow, aged fifty-eight gave a history of ten pregnancies and a cholecystomy twenty-one years previously for the relief of severe right upper quadrant pain and vomiting. Since shortly after her operation she had had chronic dyspepsia and recurrent attacks of pain with vomiting, often accompanied by an icteric tinge of the skin and sclera. The present attack began the day before admission.

The patient was obese, slightly jaundiced, in pain, with tenderness and muscle spasm in the right upper quadrant of the abdomen in the region of the old operative scar. The blood findings were: white blood cells 7,350, polymorphonuclear leucocytes 82 per cent; icterus index 60, and negative Wassermann reaction. Urine was normal. Her temperature ranged from 99.4°F. to 102°F., pulse rate 70, respirations 20 and the blood pressure was 120/70.

At operation, eight days after admission, while still febrile, a fistulous tract which led from the abdominal scar to the fundus of the gall bladder was excised. About one ounce of brownish fluid and three stones were removed from the thickened organ. No calculi could be palpated in the common bile duct and it was not opened. A catheter was sewed into the fundus and a cigarette drain was placed nearby.

The patient drained well through the catheter and from the wound, but the pulse rate remained moderately elevated and she died, with a terminal rise in temperature, on her twelfth postoperative day. The clinical impression was subacute and chronic hepatitis with hepatic insufficiency, generalized sepsis and bronchopneumonia.

Comment: Here again, it is difficult to evaluate the case without more information and an autopsy. The authors suspect, however, that the preparation of the patient was inadequate and that her chances of recovery would have been increased greatly if glucose had been administered for ten to twenty days and if the then less acutely inflamed gall bladder had been removed instead of drained. It is possible also that the common bile duct should have been explored and drained. There is no doubt but that adequate preparation would have increased the safety of that procedure. Certainly it was inadvisable to operate on this patient while she still had a fever of 101°F.

Case IV. A white laborer, aged sixty-four was seized six hours before admission with abdominal pain, nausea, and vomiting, which occurred only twice. The pain became more constant and centered in the pit of the stomach. The bowels had moved once since the onset. An incisional hernia, which arose following an appendicectomy performed two years previously, had grown progressively larger, but had caused no discomfort.

There was an old right rectus scar with subcutaneous protrusion of a mass of small intestines, 20 × 20 cm., but no visible peristalsis and no demonstrable incarceration. Tenderness was generalized over the mass, over the left side of the abdomen, and in the epigastrium. Rectal examination was negative. His temper-

ature was 98°F., the pulse rate 92, respirations 32; the blood pressure was 170/130, and the white count was 19,750 with ploymorphonuclear leucocytes 93 per cent. The urine showed a specific gravity 1.019, trace of albumin and many pus cells.

At operation, performed shortly after admission, the intestinal loops were freed insofar as was necessary in order to enter the abdominal cavity. No obstruction which could account for the symptoms was found, but an enterostomy tube was placed in one of two small holes torn in the bowel during the dissection. The gall bladder was tense, edematous, and packed with calculi. It shelled out of the liver bed with ease and was removed. A drain was placed through a stab wound, and closure was carried out in two layers without attempting to repair the hernia completely. The pathologic diagnosis was chronic cholecystitis with cholesterosis and cholelithiasis.

The patient's condition was critical shortly after operation. In spite of the use of an oxygen tent, digitalis and intravenous glucose, he became cyanosed, the respirations were labored, signs of extensive pulmonary edema developed, and he died thirty hours after operation, presumably of acute bilateral pulmonary edema and bronchopneumonia.

Comment: It is obvious that the gall bladder should not have been removed at the time. The patient had been in the hospital only a few hours and was inadequately prepared for cholecystectomy. The accidental opening of the small bowel in freeing the adherent loops within the hernial sac should have limited further operating to a minimum, of course. It cannot be determined whether or not hepatic insufficiency had anything to do with this fatality, but from the standpoint of glycogen reserve the patient was not properly prepared for cholecystectomy.

Case v. A colored domestic, aged forty-nine, was admitted complaining of pain in the right upper lumbar region for three days, and in the right lower abdomen with nausea and vomiting for eighteen hours. Recently she was constipated. There were no previous indigestion or attacks of abdominal pain. She had been in a wheel chair most of the time for three years because of weakness of the legs. There was a neurotic background.

A moderately obese, rather acutely ill negress, temperature 100°F., pulse rate 112, respirations 24, blood pressure 198/110, not jaundiced. The eyes showed bilateral early cataracts and arteriosclerotic changes in the fundi. The thyroid gland was adenomatous. The abdomen was spastic on the right with tenderness most marked over a mass in the region of the gall bladder. The uterus was enlarged and nodular. Symmetrical weakness of the muscles of legs was present but without paralysis or anesthesia and the knee jerks were sluggish. There were 11,850 white blood cells, polymorphonuclear leucocytes 79 per cent, red blood cells 4,210,000, hemoglobin 75 per cent. The urinary findings were: specific gravity 1.002, slight trace of albumin, no sugar and the sediment showed a few pus cells. Phenosulphonephthalein excretion was 65 per cent in two hours. Blood and spinal fluid Wassermann reactions were negative; spinal fluid mechanics normal. Icterus index was 17 and non-protein nitrogen 25 mgs. Basal metabolic rate was minus 11.

X-ray films showed deviation of the trachea by the thyroid adenoma, moderate cardiac enlargement, extensive hypertrophic arthritis of the lumbar spine, and calcification in a fibroid uterus. The gall bladder could not be demonstrated in cholecystograms made by the intravenous method. A barium enema was negative.

Following the administration of glucose daily during an afebrile period of four weeks, a tense gall bladder, moderately thickened and packed with stones, was removed. The common duct was normal and was not explored. Incidental appendicectomy was performed and abdominal closure was done with drainage. The pathologic diagnosis was chronic cholecystitis and cholelithiasis. A culture from the gall bladder showed no growth.

The patient was apathetic; tachycardia, low grade fever, persistent distention, and vomiting of small amounts of bile stained material occurred in spite of the presence of a tube placed intranasally into the stomach. Cultures from the drainage tract grew a hemolytic streptococcus. Returns from enemas were scanty. Left rectus exploration under procaine anesthesia on the sixteenth day after cholecystectomy was done to rule out partial intestinal obstruction or residual abscess; neither was found, nor was there any evidence of a subphrenic abscess. Urinary output was satisfactory. She was transfused. The patient became comatose and died, following a rise in temperature, nineteen

days after the original operation. Clinical impression: extensive cardiovascular disease with hypertension, hepatic insufficiency, terminal bronchopneumonia.

Comment: This patient was operated upon by one of the authors (C.E.B.). In the absence of an autopsy no definite explanation of the fatality seems possible. There was no jaundice and no extensive renal damage. It is unfortunate that tests of the hepatic function were not done before and after the lengthy preoperative course of glucose therapy. A biopsy of the liver was not made. It is possible that the liver was badly damaged and that the response to treatment with carbohydrates was insufficient.

Case VI. A white watchman, aged sixty, had had pain for three days in the lower abdomen and in the costovertebral angles, bilaterally, but no nausea or vomiting. During this time he had been unable to void more than two or three tablespoonfuls of urine daily, and his bowels had not moved. He had no previous attacks of abdominal pain. He had had typhoid fever many years ago.

The patient appeared drowsy. There was moderate muscle spasm and diffuse tenderness in the right lower quadrant of the abdomen. An *x*-ray film showed a great deal of intestinal distension with the pattern of the colon well outlined. His temperature was 96°F., pulse rate 75, respirations 22, blood pressure 90/75; leucocytes 13,750, polymorphonuclear leucocytes 90 per cent and nonprotein nitrogen 30.3 mgs. Urinalysis showed trace of albumin, sugar negative, occasional pus and red blood cells in the sediment. The differential preoperative diagnosis was acute suppurative appendicitis or perforated peptic ulcer with generalized peritonitis and paralytic ileus.

Exploration shortly after admission revealed a large amount of yellow pus in the right colonic gutter originating from a partially gangrenous and perforated gall bladder which contained many small stones and much muddy material. The intestines were distended. A catheter was sutured into the gall bladder and the abdomen was closed with drainage.

The postoperative course was septic. He was irrational most of the time, greatly distended, and on the eleventh day developed a fecal fistula in his gaping, infected wound. He died on the thirteenth postoperative day. An autopsy, which was limited to inspection through the wound of operation, showed a perforation of the ileum at the site of the partially separated wound, localized peritonitis, acute suppurative cholecystitis, cholelithiasis with obstruction of the cystic duct, acute degeneration of the liver and other viscera, and a diverticulum of the duodenum. The common duct was patent and contained no stones.

Comment: This patient was so acutely ill that recovery could not be expected except under the most favorable conditions. The rupture of the wound and strangulation of a loop of ileum were complications which could not be survived. The notes indicate that the patient was too ill to stand secondary suturing of the wound and that the infection of the wound made the advisability of resuturing problematical. All in all, in the face of a ruptured gall bladder and intestinal distention at the time of operation, it is not justifiable to criticize this fatality adversely.

DISCUSSION

It should be noted that in 5 of the 6 fatal cases the patients were inadequately prepared for operations on the biliary tract. In 4, a delay in the drainage or removal of the gall bladder was possible and during that time glucose could have been administered; also in 3 cases the acute inflammation in the gall bladder could have been allowed to subside. In only one instance, in which there was a ruptured gall bladder, did the situation require emergency operation on the biliary tract without adequate preparation. Much has been written about the thorough preparation of jaundiced patients for operation, but the authors feel that insufficient emphasis has been placed on the careful preparation of patients with acute and chronic cholecystitis in the absence of jaundice. Graham,[1] was able to reduce sharply the mortality rate in biliary diseases in his clinic by insisting on the preoperative administration, except in emergency cases, of glucose for ten or more days whenever the retention of phenoltetraiodophthalein was more than 50 per cent in one-half hour. A simple substitute for this plan, which we have used,

is to carry out the treatment with glucose in all elective cases without resort to the test. In private practice, many patients are able to take the glucose by mouth in the form of candy or orange juice before hospitalization while they are ambulatory or in bed at home. The safest method, however, is to repeat the test until the retention decreases to within normal limits. We feel that this should have been done in Case v, and that operation might have been contraindicated on the basis of persistent retention of the dye even after several weeks of therapy with glucose.

The authors believe that patients with acute cholecystitis should not be operated upon unless there is evidence of rupture of the gall bladder or acute pancreatitis. With these complications constantly in mind the patients should be kept under careful observation with a high carbohydrate intake. A very large proportion, at least 90 per cent, become asymptomatic and free from fever within two weeks and can then be operated upon with safety. If a patient is operated upon as an emergency, either under a mistaken diagnosis or because of the fear of a ruptured gall bladder or an acute pancreatitis, and simple acute cholecystitis is found, we believe that the abdomen should be closed immediately, without cholecystostomy or cholecystectomy or drainage of the peritoneal cavity. The inflammation should be permitted to subside spontaneously so that the gall bladder can be removed subsequently in a quiescent state after adequate preparation with glucose. It is recognized that there occurs rarely a case in which at exploration rupture of the gall bladder obviously is imminent. In this circumstance the gall bladder requires drainage or removal, but in the simple acute and doubtful cases the authors believe that the omentum should be wrapped around the gall bladder and that it should be left alone.*

SUMMARY

Operations for diseases of the biliary tract were performed in the Louisville City Hospital by twenty-five surgeons on 134 patients during the five year period between January 1, 1930, and January 1, 1935. The mortality rate was 4.5 per cent. Although this figure is fairly satisfactory, the authors feel that several of the fatalities could have been prevented by delayed operations and adequate preparation with glucose over a ten day to three week period.

Delayed operations are recommended in cases of acute cholecystitis. It is believed that by careful observation the onset of perforation or acute pancreatitis can be detected and proceded against promptly if either occurs. If at the time of an emergency operation under a mistaken diagnosis a simple acute cholecystitis without imminent perforation is encountered, it is recommended that the omentum be wrapped around the gall bladder, the abdomen closed without drainage and the gall bladder be removed ten days to three weeks later after subsidence of the acute inflammation and after adequate preparation with carbohydrates.

REFERENCES

1. Graham, E. A. Estimating the risk of operations on the biliary tract by testing the excretory function of the liver. *Radiology*, 21: 191–194, 1933.
2. Blalock, Alfred. A statistical study of 888 cases of biliary tract disease. *Bull. Johns Hopkins Hosp.*, 35: 391–409, 1924; also, A clinical study of biliary tract disease. *J. A. M. A.*, 83: 2057–2060 (Dec. 27) 1924.
3. Hitzrot, J. M., and Cornell, N. W. An analysis of 482 gall-bladder cases treated in the First Surgical Division of the New York Hospital. *Ann. Surg.*, 84: 829–832, 1926.
4. Judd, E. S., and Parker, B. R. Mortality following operations on the biliary tract, pancreas and liver. *Ann. Surg.*, 84: 419–437, 1926.
5. Fowler, R. S. Gall-bladder disease, one thousand end results. *Am. J. Surg.*, 22: 53–59, 1933.

* Those who are interested in articles in which are reported larger series of cases should refer to the papers of Blalock,[2] Hitzrot and Cornell,[3] Judd and Parker,[4] and Fowler.[5] At the Johns Hopkins Hospital, Blalock found that the proportion of white to colored patients who were seen with diseases of the biliary tract was 32 to 1, whereas the proportion of white to colored patients on the surgical service as a whole was 5 to 1. That meant that the white patients were afflicted with diseases of the biliary tract about six times as often as the colored patients. In our shorter series the difference is less striking, the proportions being, respectively, 3.6 to 1, and 1.7 to 1, so that the white patients had diseases of the biliary system 2.2 times as often as the colored patients.

NON-PADDED PLASTER CAST FOR LOWER EXTREMITY*

R. A. GRISWOLD, M.D., F.A.C.S.

Associate Professor of Surgery. Surgeon, Louisville City Hospital.

LOUISVILLE, KY.

TRACTION and suspension methods with such accessories as the Thomas splint have played a predominant part in the development of the modern treatment of fractures. Their evolutionary importance cannot be over-emphasized, though they have, however, certain deficiencies. The patient must be immobilized to obtain immobilization of the broken bones and is neither ambulatory nor portable. Constant checking and readjustment of the apparatus is required, for even though good position may be obtained at first, subsequent displacement is not uncommon. Hospitalization which is a considerable factor in these times of economic stress is prolonged. Considerations such as these have led to the development of more efficient procedures, notably by Boehler[1] in Europe and by John Caldwell,[2] Roger Anderson,[3] and others[4] in this country. Traction-suspension methods may now be replaced to a large extent by more efficient means of reduction followed by fixation in plaster of Paris, which is the most satisfactory dressing for most fractures. Often fixed traction, or to use a better term, skeletal fixation in plaster, is advantageous. Plaster splints or casts are made to fit the individual with accuracy impossible to attain by other means. They offer better control of position and are more comfortable than any metal or wooden splint. The patient is comfortable, ambulatory or at least portable and final anatomical and functional results are good. Skillful application of a suitable retention dressing is equally as important as a good reduction of the fracture.

The technique of plaster fixation has been neglected in recent literature. Most authors writing on the newer methods of treatment treat the subject lightly and chapters devoted to splints and casts in the new textbooks are inadequate and outmoded. This is especially true of the use of non-padded plaster. The monographs of Boehler[1] and Schnek[5] are almost the only exceptions. Lack of appreciation of the theoretical and practical considerations involved in the proper use of the plaster dressing, in particular the non-padded variety, has contributed to the widespread failure to realize its advantages and possibilities.

Advantages of Non-padded Plaster Casts. The non-padded plaster cast has numerous advantages over the conventional padded casts, the most important is that fixation is incomparably more secure. Padding, no matter how skillfully applied, is subject to compression and thinning with an increase of the space between the skin and the cast, inevitably leading to looseness and motion within the cast. In some fractures this motion may cause nothing more disastrous than a spasm of pain each time the limb is moved until the formation of callus stops the painful grinding of the fracture surfaces. In others, especially those which are comminuted or which involve joints, motion of the atrophied, functionless limb in a loose padded cast may result in shortening, deformity or disabling mal-alinement of the joint surfaces. This is particularly true of fractures of the shaft of the femur, the condyles making up the knee, the mortise of the ankle and the astrogalocalcaneal joint. Molded smoothly and evenly over the bony prominences and soft parts, non-padded plaster firmly holds fragments

* From the Department of Surgery of the Louisville City Hospital and the University of Louisville School of Medicine.

in apposition and prevents painful motion. The addition of a protective heel to the cast allows walking, including weight bearing. Absence of pain permits full active functional use of the part without muscle spasm. Continuous active motion is natural physiotherapy and is superior to any artificial and intermittent type, whether active or passive. The ability to use the extremity without pain tends to prevent the disabling limitation of motion so common after immobilization in padded casts. This stiffness is caused, not so much by adhesions within the joint, as by fixation of the muscles, tendons and capsular fascia surrounding the joint. When the extremity enjoys functional use during the period of immobilization these tissues are well nourished, free and supple at the end of the healing period. With each step the muscles and tendons move easily in their sheaths without pain from the firmly fixed bones. Even those muscles whose origins and insertions are so fixed in the cast that they cannot approach each other, undergo contraction and relaxation. The pumping action of the contracting and relaxing musculature takes the place of massage and maintains a normal flow of blood. This to a large degree prevents atrophy and late posttraumatic edema. Even the joint capsules and synovia are moved by the muscle slips inserted into the capsules. Immediately on removal of a non-padded weight bearing cast the previously fixed joint may usually be moved actively through one-half and often through its full nomral range of motion. The normal nutrition and absence of stasis hastens healing of the fracture, as does the mild intermittent pressure on the bone with each step.[6]

Paradoxical as it may seem, pressure and friction sores are less frequent with the non-padded than with the padded casts. The reason for this is not difficult to understand. Plaster accurately molded to the skin equally distributes pressure and stress over the surface of the limb, avoiding concentration of pressure at any one point sufficient to cause necrosis and firm adhesion of the cast to the skin prevents friction. In the padded dressing there is always some motion between the limb and the case. The slight change of position which occurs may compress the padding over the bony prominences to a hard thin layer. The entire pressure of the displacing force, whether it be body weight or muscle pull, is then concentrated on the few small areas where the bony prominences have pressed through the padding. If this pressure is great enough and is continuous anemic necrosis appears. If the pressure is intermittent and tangential friction sores may develop.

Indications for Non-padded Plaster Casts. The non-padded cast may be indicated in all fractures and dislocations of the lower extremity which have been satisfactorily reduced. It is especially useful in conjunction with the walking iron in the prevention and treatment of delayed union. Patients with severe sprains of the knee and ankle may start painless weight bearing immediately. The non-padded cast equally with the padded variety should not be used in the presence of severe soft tissue damage which might result in marked swelling and circulatory disturbance unless the cast is immediately split throughout its entire length. Boehler's method of massaging and pressing away the swelling at the time of fixation somewhat after the fashion of reducing a paraphimosis is useful. In this connection it may well be reiterated that the surest way to prevent and reduce swelling is to reduce the fracture. This fact is not sufficiently appreciated and is sometimes neglected with disastrous results. In modern fracture treatment the fracture is reduced without waiting for the swelling to subside. An equally important item is elevation of the extremity both before and immediately after reduction and fixation, in order to prevent swelling rather than to treat it after it occurs.

The non-padded cast should be used with careful discrimination or not at all in the correction of orthopedic deformities. In the

treatment of fractures the cast merely maintains the parts in their normal state, while in many orthopedic maneuvers the dressing must hold a corrected or over-corrected limb in a position which is distinctly abnormal for the previously deformed member. In such a case, unforseen concentrations of pressure may occur.

General Considerations. The plaster bandages to be used may be prepared in the office or hospital or may be purchased readymade. Adequate directions for their preparation are contained in most standard texts on fractures. They should be made of the best grade of dental plaster, thoroughly rubbed into a good quality crinoline gauze, 28 by 32 mesh. The crinoline should be notched at the edges to prevent raveling. The bandages should be rolled loosely enough to be rapidly saturated when immersed and should be stored in moisture proof containers until ready for use. Bandages five yards long and of two widths, 4 and 6 inches, are adaptable for all dressings of the lower extremity. Within recent years most surgical supply houses have put on the market plaster bandages which are equal or superior in quality, uniformity and long run economy to the usual hospital made bandage. The most satisfactory of these are hard surfaced in such a manner that little plaster is lost in handling, with the result that strong casts may be made with one-half to two-thirds of the number of bandages employed previously.

Four types of casts are used on the lower extremity. (1) the knee length boot for injuries about the distal to the ankle; (2) the upper thigh cast for fractures of the leg; (3) the groin cast with counter pressure pad against the ischial tuberosity which is used for injuries about the knee; (4) the spica for fractures of the femur. These casts are of increasing magnitude and importance and should be approached and mastered in order. It is well for those wishing to train themselves in the use of the non-padded plaster to limit their first few attempts to the reapplication of boot casts on patients with old fractures. This will relieve the operator of the burden of maintaining reduction, will obviate the danger of swelling and will make errors of technique less harmful. When such patients can bear weight without pain or difficulty the surgeon may graduate to the field of acute fractures and more extensive casts. This caution applies just as much to the experienced surgeon accustomed to padded casts as it does to the medical student or interne. Considerable time spent in teaching this method has even led me to believe that previous experience is a hinderance rather than a help in grasping the principles of technique.

The hair is not shaved nor the skin greased before the application of plaster since shaving may cause troublesome skin infections and grease weakens the cast. Uniform incorporation of the hair in the cast gives firm adhesion to the skin and prevents friction between the skin and the cast. Any pull is so evenly distributed among the hairs that it is painless. These hairs die in two or three weeks and separate from the skin without pain when the cast is removed, by which time a new growth of downy hair has appeared. It is well to note here that with the method of functional treatment, early removal of the cast for physiotherapy is neither necessary nor desirable. The sole of the cast should be extended slightly beyond the tips of the toes to prevent flexion contracture and to protect the toes from the weight of the bed clothes. It is extremely important that the dorsum of the foot be covered to the base of the toes although these should be exposed for inspection. If the plaster does not extend to the base of the toes, edema of the dorsum of the foot will occur when the extremity is dependent, just as it occurs distal to an improperly applied elastic bandage. The sharp edge of the cast will then cut into the swollen skin and further trimming will only make the condition worse. Application of pressure to the swollen area by several firmly wrapped layers of adhesive tape will relieve the edema. For the same reason the cast

should not be windowed if the patient is to be ambulatory. Most clean wounds do well if not frequently redressed and we



FIG. 1. FIG. 2. FIG. 3.

FIG. 1. Posterior splint applied as first step in boot cast. Note close molding about heel and malleoli and plaster doubled beneath and beyond toes.

FIG. 2. Anterior splint from tibial tubercle to base of toes. Notched over instep to allow smooth fitting.

FIG. 3. Boot cast complete. Note accurate application on dorsum of foot down to base of toes. This prevents edema. 90° flexion at the knee is possible.

routinely leave silk skin sutures in operated or compound fractures until the cast is removed in 6 or 8 weeks. Dressings on wounds beneath the plaster should be as thin as possible, three or four layers of gauze being sufficient and should not be held in place with a circular bandage which will shrink and cause circulatory disturbances after contact with wet plaster. Due to its alkalinity, plaster is bacteriostatic to the usual pathogenic organisms, so infection through a thin dressing need not be feared. If windowing cannot be avoided, enough pressure should be applied over the window between dressings to prevent edema. Longitudinal, anterior and posterior splints are used as the basis of all non-padded casts. They may be molded more smoothly to the contour of the limb than circular turns, and they materially increase the strength of the cast. They also prevent circulatory disturbances by distributing any pressure which might be caused by the tight edge of a circular turn.

If the loose plaster bandage is to be used, it is completely immersed on end in water of about body temperature. As soon as bubbling ceases the bandage is lifted from the water and gently drained to remove excess water, holding both ends of the roll to prevent the escape of plaster. The beginner invariably squeezes the bandages too dry for the non-padded technique; it should be definitely "soppy." To prepare a splint the bandage is unrolled back and forth on a glass, marble or enameled surface to the previously measured correct length until the necessary thickness is obtained, about six or eight layers. Each turn is gently rubbed once with the flat of the hand to smooth it and bind it closely to the previous layer avoiding wrinkles and ridges. The splint is now ready for immediate application and should be soft and wet enough to mold and adhere to the skin of its own accord. Do not make the splint so thick and so dry that it cannot settle itself to the contour of the limb. If the hard surfaced commercial bandage is used the splint is made by unrolling and folding the dry bandage to the desired length and thickness, three or four layers making a sufficiently strong splint. One end of the dry splint is held in each hand and it is run rapidly once through water from end to end. It is now ready for application.

The Boot Cast. This cast is used for lesions about and distal to the ankle. It is ordinarily applied with the foot at right angles to the leg and the knee flexed.

A convenient way to attain this position is to have the patient lie on his abdomen with the leg vertical. If the fracture has

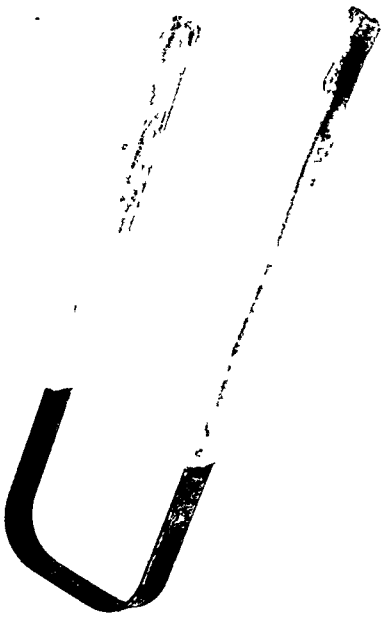


Fig. 4. Strap iron, 24 inches by ¾ inches by ⅛ inch, bent to correct shape. Plaster on arms of iron to aid fixation.

been reduced under local anesthesia the conscious patient can easily maintain this position and no assistant is necessary to hold the leg and cause dents in the cast. A previously measured wet splint 6 inches wide is applied to the posterior surface of the leg and foot from the bend of the knee to a point ½ inch distal to the tips of the toes. This splint should be long enough so that 3 or 4 inches of it may be folded back along the sole. The splint is cut on each side of the heel one-third of its width to allow folding over and close molding. The plaster is smoothed onto the skin with the flat of the hand and should be wet enough to adhere. (Fig. 1.) Wrinkles and air spaces beneath the plaster should be smoothened out, especially over the sole and along the Achilles tendon. A similar splint is applied to the anterior surface from the top of the tibial tubercle to the base of the toes. The edges of this are likewise cut over the instep to avoid wrinkles. Special attention is paid to accurate molding over the crest of the tibia and the bony prominences of the ankle. (Fig. 2.) If steel pins have been used in reduction



Fig. 5. The iron has been fixed in the weight bearing line of the leg with scant two finger's distance from iron to sole. Most of plaster has been applied at upper end of iron to resist upward thrust. Loops are taken about iron to assist fixation.

and are to be incorporated in the cast, the splints are cut to closely surround them. Circular turns are now added from the base of the toes to the top of the splints. These should be rolled on smoothly and evenly and not drawn snug or tight. The bandage should not be reversed and should be applied in an evenly ascending spiral with an occasional smooth fold. Each layer is rubbed into the succeeding one with the flat of the hand. If pins are to be incorporated, loops are taken about them on each side of the limb so that they are firmly fixed in the plaster. If support of the limb is necessary during the application of the cast, it should be applied by the palm with extended fingers to avoid circumscribed dents in the plaster. The position of the ankle joint must not be changed during the application or setting of the cast or wrinkles will occur. Two or two and a half rolls of 6 inch hard surfaced plaster are sufficient for a boot cast. If pins have been used the sharp ends are covered with corks held by additional plaster. Any necessary trimming of the cast is done as soon as the plaster has set, usually about fifteen minutes. At the upper

end of the cast the plaster should reach to the tibial tubercle anteriorly but should be trimmed behind to allow right angle



Fig. 6. Fig. 7.

Fig. 6. Cast for fracture of ankle after 6 weeks of ambulatory treatment. Worn plaster on dorsum of foot has been repaired with adhesive.

Fig. 7. Same cast as Figure 6 seen from behind.

flexion of the knee. (Fig. 3.) If the cast is cut too low the soft tissues of the calf will bulge over and be irritated by the edge of the plaster. The patient is transported to bed with the cast on a soft pillow to prevent flattening over the calf and heel from pressure. The extremity is elevated 8 to 10 inches above the bed beneath an electric light bake for twenty-four to forty-eight hours for thorough drying of the cast and to prevent swelling in fresh fractures.

The Walking Iron. The walking iron heel which we use is a 24 inch length of ordinary $\frac{1}{8} \times \frac{3}{4}$ inch strap iron which may be obtained from any machinist or blacksmith supply house. The crosspieces used by Boehler are unnecessary and increase the expense. The iron is usually not applied for twenty-four hours. This allows the cast to dry and prevents pressure from the iron. The iron is bent by hand or wrenches into a flat bottomed "U" slightly wider than the malleoli, accurate modeling not being necessary. The arms of the "U" are covered with one layer of wet plaster to aid cohesion. (Fig. 4.) The iron is fitted with the arms over the malleoli and accurately placed in the weight bearing

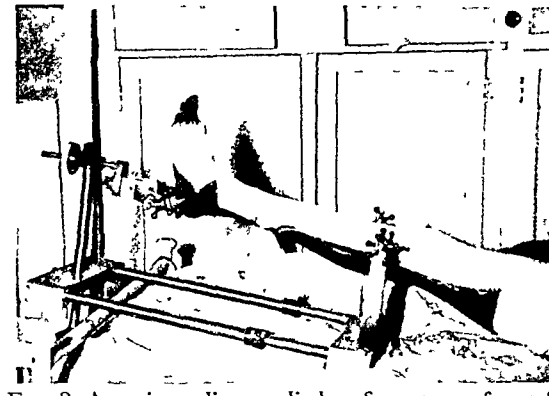


Fig. 8. Anterior splint applied as first stage of cast for compound comminuted fracture of tibia and fibula. Extremity is in skeletal reduction and fixation apparatus. Note smooth molding to skin. A circular layer of flannel at upper end of cast prevents friction.

axis of the leg. (Fig. 5.) If the iron is placed anterior to the weight bearing axis, the knee tends to hyperextend when the patient attempts to walk. When the iron is too far posterior the patient attempts to flex the knee on weight bearing and the toe of the cast rests on the floor. Either of these positions will cause pain. A scant two finger breadth is allowed between the sole and the iron. One-half of a 6 inch plaster bandage is sufficient for fixing the walking iron. A circular turn about the ankle is followed by loops or half-hitches about the iron on each side to prevent anterior or posterior motion. Most of the plaster is used for circular turns about the upper end of the iron to firmly bind it to the cast and take up the vertical strain of weight bearing. Walking is allowed twenty-four hours after application of the iron. (Fig. 6 and 7.) A 3 or 4 inch length of old garden hose slipped over the iron makes a good non-skid cushion and prevents the iron from scratching floors.

Thigh Length Casts. For injuries between the ankle and the knee the cast must be extended to the upper third of the thigh. A single layer of soft flannel about 6 inches wide should encircle the thigh at the upper edge of the cast to prevent friction from

the sharp plaster. The laxity of the fleshy thigh makes this necessary since the upper portion of the cast cannot be snugly molded

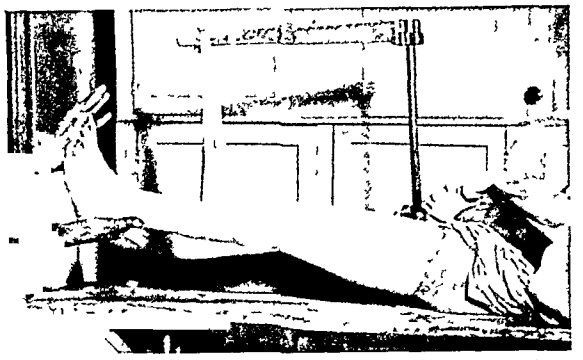


Fig. 9. Both splints applied for simple transverse fracture in which skeletal reduction and fixation was unnecessary. Muslin sling beneath fracture site supports weight of leg and makes accurate alinement much easier. "Anyone can reduce a fracture of the leg, but few can maintain corrected position while the case is being applied." Any overhead object to which a bandage may be tied may be used in place of a Hawley table.

to the bony prominences as at the knee. All casts fixing the knee must be applied with this joint extended (not hyperextended) if the patient is to be made ambulatory. (Fig. 8.) Attempts to bear weight with the knee partly flexed cause friction, pain and pressure over the patella. The application of this cast is simplified by suspending the extremity from an overhead bar by not more than two slings of 6 inch unbleached muslin bandage. (Fig. 9.) One sling should be placed at the fracture site in order to maintain anterior bowing, the second just above the knee. This relieves the assistant of the weight of the leg and allows him to concentrate on maintaining traction and alinement.[7] Special care should be taken to see that there are no wrinkles or folds in those parts of the sling in contact with the skin. Anterior and posterior splints are applied from the middle of the flannel bandage downward to the same limits as for a boot cast. The edges of the anterior splint are cut opposite the patella and the sling to allow for accurate molding. The plaster must fit evenly and smoothly over the patella and the heads of the tibia and fibula. Air pockets must be smoothened out around and between the ham-string tendons. Short lateral splints may be molded

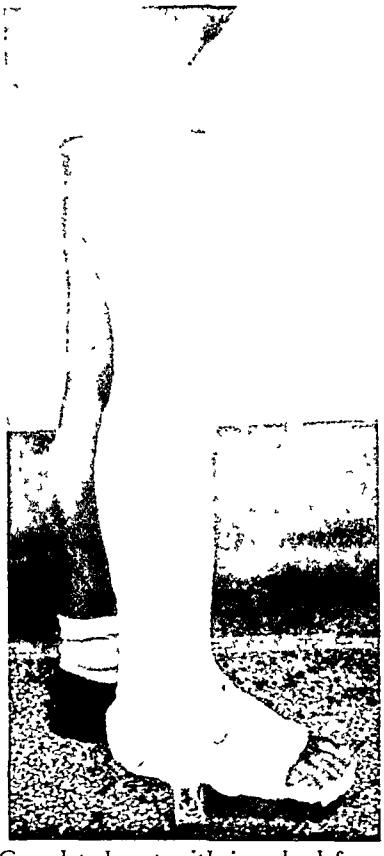


Fig. 10. Completed cast with iron heel for compound fracture of tibia and fibula. Note limits of cast, pin ends protected by corks and plaster and position of walking iron.

about the knee for additional strength. The distal portion of the cast is constructed as before and the circular turns continued to the top of the splints. These turns surround the slings in figure of eight fashion anteriorly and posteriorly. The proximal turns of plaster should be sufficiently snug to hold firmly the relatively flaccid soft tissues of the thigh. The danger of circulatory disturbance from tight application of plaster is not nearly so great as in the leg and foot because of the fleshiness of the thigh. As soon as the plaster has set the slings are cut on both sides close to the cast and their ends loosened from the plaster to relieve tension. Another layer of plaster is applied over these areas to finish the cast. A good non-

padded cast of this type sufficiently strong for weight bearing may be made from not more than four 6 inch bandages. (Fig. 10.)



FIG. 11. Position for application of cast for simple transverse fracture upper end of tibia and fibula. The perineal roll is shown pulled firmly against the tuberosity of the ischium and the origin of the adductors by an assistant.

Occasionally the thigh portion of this type of cast is found to be loose after a few weeks. This will allow slight motion at the knee and cause pain from friction over the patella. Relief may be obtained by removing a wedge shaped section from the posterior aspect of the cast down to the knee and reapproximating the edges with plaster. This maintains extension of the knee and prevents motion. If the wedge is removed from the anterior aspect of the cast the knee becomes slightly flexed and walking is impossible.

The Groin Cast. The groin (Thomas caliper type) cast is used for fractures involving the upper end of the tibia, the patella and for the convalescent support of some fractures of the shaft of the femur. It includes at its upper end a padded roll similar in size, consistency and function to the ring of a Thomas splint or walking caliper brace. This roll, resting against the tuberosity of the ischium and the origin of the adductors, transfers some of the stress of weight bearing to the pelvis. The pad is made by rolling tightly an 8 × 10 inch piece of silence cloth or thin felt about the center of a three foot length of muslin bandage. This roll is completely covered by a spiral of one inch adhesive tape which compresses it to the size and firmness of a Thomas splint roll. It is applied with its center over the tuberosity of the ischium, the posterior end lying



FIG. 12. Completed groin cast. The shelf of plaster holding the perineal roll in place is well shown. The distance from sole to heel is too great. This is not so obvious when the shoe is worn on the other foot.

in the gluteal fold and the anterior end crossing the hip joint. By pulling firmly outward and upward on the ends of the bandage, the pad is snugly fitted beneath the tuberosity and the origin of the adductors. (Fig. 11.) Anterior and posterior splints are applied from the pad downward. The upper circular turns incorporate the pad and are snugly molded on the medial side to form a shelf like structure which holds the roll firmly against the ischium. Five 6 inch hard surfaced bandages are sufficient for this type of cast. (Fig. 12.)

The Hip Spica. The spica is used for all fractures of the femur. This cast is most easily applied with the patient on the Hawley table with traction supplied by a Collin's hitch about the ankle and support of the knee by a muslin sling.

Since the skin of the thoracic and abdominal walls moves with respiration it must be protected from friction, as must the bony prominences of the pelvis, which cannot be completely immobilized. Accordingly, the anterior superior spines and the sacrum are covered by patches of silence cloth which are held in place by a stockinette or a circular layer of flannel bandage extending from the xiphoid to the trochanter. This bandage should be wrapped tightly about the pelvis in figure of eight fashion to compress the lax buttocks. A padded roll is snugged to the tuberosity of the ischium as for the groin casts. One layer of flannel is applied to the leg just above the ankle hitch. (Fig. 13.) Circular plaster bandages are applied snugly to the trunk and pelvis and molded about the crests and spines of the pelvis. (Fig. 14.) Anterior and posterior splints are molded to the skin from the lower third of the leg up over the pelvic portion of the cast. The region of the hip is strengthened by four or five spica-wise splints which also support the ischial pad. The whole is covered with circular plaster. (Fig. 15.) While the plaster is setting an assistant should apply constant pressure on both sides of the pelvis to mold the plaster to the crests of the ilia and the hollows between the crests and the trochanters. When the plaster has set firmly twenty or thirty minutes, the leg is supported and the Collin's hitch removed. Anterior and posterior splints are placed from the toes to overlap the previous plaster about 6 inches and are covered with circular turns as in the other casts. Trimming of the cast is done to uncover the upper abdomen and allow free motion of the uninjured thigh. (Fig. 16.) The patient is turned on his abdomen and trimming of the posterior part of the cast carried out. It should be cut to the top of the cleft of the buttocks and about 2 inches to the side along the cleft to allow use of the bed pan. (Fig. 17.) If trimmed too far over the buttock, bulging and irritation from the edge of the cast will occur.

Unless properly tended in the first forty-eight hours these casts may crack at the hip. Breaking at the hip is almost always



Fig. 13. Patient with fracture of the shaft of the femur in traction on the Hawley table. Pins are inserted in both fragments for manipulation and skeletal fixation. Note perineal pad and silence cloth over spines and crests of pelvis and over vertebra. Flannel bandage about leg above Collin's hitch.

due to adduction force. Therefore, in turning these patients they should be rolled toward the well side with adequate support of the casted limb. Better yet, if enough help is available, turning is accomplished by lifting the patient straight up, turning him in the air and laying him down. After forty-eight hours a properly constructed cast should not crack. For an adult of average size twelve to fourteen hard surfaced 6 inch bandages are sufficient to make a spica which will stand constant weight bearing. Such a cast will weigh about twelve pounds.

Circulatory Disturbances. In almost all cases proper elevation of the injured extremity before and after reduction will prevent dangerous circulatory disturbance even in fresh fractures. Severe soft tissue injury or neglect of elevation may cause excessive pressure within the cast at the site of fracture. A vicious circle is then established. Swelling causes pressure which obstructs the venous and lymphatic return flow thus leading to more swelling. The only remedy is *immediate splitting of the cast throughout its entire length.* Partial splitting distal to the fracture is useless. The signs of pressure in the order of their appearance

in the toes are: (1) edema, (2) cyanosis, (3) loss of sensation and (4) impaired motion. Edema and cyanosis may be

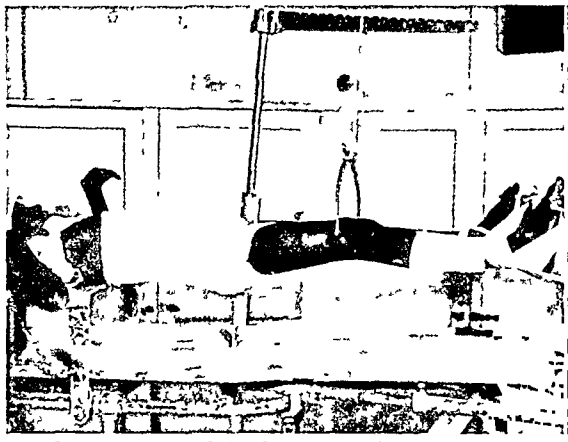


FIG. 14. Stockinette and the first layer of circular plaster have been applied snugly about the trunk and pelvis incorporating the upper pin.



FIG. 15. Splints and circular turns applied to trunk, pelvis, thigh and leg down to middle of flannel bandage. All three pins are closely incorporated in plaster. This portion is allowed to set (20 to 30 minutes) before traction is released and distal portion of cast completed.

treated by elevation and careful observation. Inability to wiggle the toes and loss of sensation, however, are immediate



FIG. 16. FIG. 17.

FIG. 16. Complete spica. Note high fixation of trunk and trimming for abdominal movement and flexion of uninjured thigh. Covered pin ends are clearly shown.
FIG. 17. Posterior view of the same cast. Note shelf for perineal pad and proper trimming about buttocks.

indications for splitting of the cast, as is excessive pain at the site of the fracture. Schneck[5] says, and quite truly, "As long as localization of the part touched is possible, the circulation can be considered adequate." If circumstances are such that the patient with a fresh fracture cannot be observed every six hours for the first day, the cast whether padded or not, should be split in anticipation of trouble. It should be split along that side of the extremity which will give the greatest relief to circulation with the least danger of displacement of the fracture. In the leg this is laterally rather than over the poorly covered tibia. The pressure of the swelling itself usually spreads the cast open the necessary amount. Occasionally it must be spread further and it is especially necessary to be sure that every thread of the circular bandage has been divided. When the swelling has subsided, the cast may be reapproximated with adhesive tape or another layer of circular plaster.

Removal of the Cast. Non-padded casts should not be removed before three weeks. By the end of this time the incorporated hairs have died and will pull painlessly from the skin. Instruments used for removing or splitting the cast are the parrot beak cast knife, cast cutters and spreaders. The walking iron is usually removed first. Then cutters are used, running down the lateral side of the cast and behind the lateral malleolus, avoiding the bony prominences.

In using the cutters it is best to take small bites with the cutter blades at a 45° angle to the cast. The blades merely grip the cast rather than shear it. Raising the handles with a can opener motion completes the cut. The knife is used in difficult angles or over bony prominences. The parrot beak tip is inserted beneath the cast with the back of the blade against the skin, cutting outward. If these directions are followed there will be no injury to the skin. Occasionally transverse cuts must be made before the cast can be spread sufficiently to remove it from the limb.

CONCLUSIONS

1. The non-padded plaster cast supplemented by skeletal fixation when necessary is the most satisfactory dressing for the majority of fractures of the lower extremity.

2. Incomparably secure fixation is provided and the patient is ambulatory or at least mobile.

3. Active use and weight bearing lessen the temporary and permanent disability.

4. Four types of casts are useful for injuries of the lower extremities, the knee length boot, the thigh cast, the groin cast and the spica.

5. Directions for the proper application of these casts are given.

6. Circulatory disturbances may be avoided with proper care.

REFERENCES

1. Lorenz Boehler. Treatment of Fractures, 4th English Edition translated by Ernest W. Hey Groves, Wm. Wood & Co., Baltimore, 1935.
2. Caldwell, John A. *Ann. Surg.*, 97: 161–176, 1933.
3. Anderson, Roger. *Surg. Gynec. Obst.*, 58: 639–646 (March) 1934.
4. West, W. K. *Jour. Am. Med. Assn.*, 101: 2036–2038 (Dec. 23) 1933.

Eikenbary, C. F., and Lecocq, J. F. *J. Bone and Joint Surg.*, 15: 643–650 (July) 1933.

White, J. W. *South. M. J.*, 25: 218–222 (March) 1932.

Carter, R. M. *J. Bone and Joint Surg.*, 15: 737–742 (July) 1933.

Pitkin, H. C., and Blackfield, H. M. *J. Bone and Joint Surg.*, 13: 589–594 (July) 1931.

Bosworth, D. M. *Surg. Gynec. Obst.*, 52: 893 (April) 1931.

Griswold, R. A. *Surg. Gynec. & Obst.*, 58: 900–902 (May) 1934; 60: 848–852 (April) 1935.

Idem. *Jour. Am. Med. Assn.*, 1935, 104: 35–40.

Hawley, George W. *J. Bone & Joint Surg.*, 16: 976–980, 1934.

5. Schnek, Fritz. Vienna. Wilhelm Maudrich, 1932.
6. Griswold, R. A. *The Physiotherapy Review*, 15: 4, 1935.
7. *Magnuson*, Paul B. Fractures. J. B. Lippincott Co., Philadelphia, 1933, page 28.

INFECTIONS OF PAROTID GLAND*

FURTHER STUDIES ON ETIOLOGY AND TREATMENT; SIALOGRAMS OF NORMAL AND ABNORMAL GLANDS AND DUCTS INCLUDING TUMORS

WILLIAM H. HOBBS, M.D. AND HYMAN SNEIERSON, M.D.

Attending Surgeon, Binghamton City Hospital

Associate Attending Surgeon, Binghamton City Hospital

BINGHAMTON, N. Y.

SINCE the publication in 1935 of our report on infections of the parotid gland, there have been many more contributions to the literature. Great strides have also been made in the use of iodized oil injections for the visualization of tumors of the parotid. We have, therefore, felt encouraged to present further reports of our work along this line as well as a review of current literature.

ETIOLOGY

There is still a difference of opinion as to the method of infection, the concensus gradually swinging to the ascending theory as against the hematogenous. The most authentic report which we found was by Kamniker.[11] In acute parotitis he obtained consistently cultures of staphylococci from Stenson's Duct. The striking case reports were those of a patient with typhoid fever and a positive blood culture and another with pneumonia. In each case culture showed staphylococci predominating without the organism causing the main condition being present. Leithauser and Cantor[13] also found staphylococci in cultures from the duct and from the incised gland in almost all cases where a culture was obtained. Talbot[20] reports staphylococcus infection of the parotid in a case of pneumonia.

In our first paper we agreed with these general views. We, however, felt that hematogenous infection does occur and cited one case in our series of 16 in which, in our opinion this had happened. (Case v.[10]) We postulated the theory that there was a difference in the appearance of the orifice of the duct between cases of ascending and of hematogenous infection. In the ascending type, the orifice would be red, pouting and swolling, with pus oozing from it or be expressed by pressure on the gland or duct. In the hematogenous type, the orifice would be normal or only slightly reddened, would not pout or be swollen, and pressure would cause the appearance of normal saliva. This statement has apparently been overlooked by later writers. It is to be expected and yet rather striking that the duct orifice in mumps is normal in appearance.

At the time of writing we were unaware of the classical experiments carried out by Berndt, Buck and Buxton[4] under the

MICROSCOPIC APPEARANCE OF INFECTED PAROTID GLANDS

Ductogenous Parotitis	*Hematogenous Parotitis*
1. Distention of ducts with purulent exudate.	1. Purulent exudate in ducts less marked. Ducts not distended.
2. Large ducts involved most extensively, small radicals least.	2. Large ducts relatively unchanged. Small radicals chiefly involved.
3. Extensive destruction of duct epithelium.	3. Epithelial lining of ducts intact, or occasionally hyperplastic.
4. Periductal reaction most prominent where duct wall is broken.	4. Periductal reaction more uniform in distribution.
5. Periductal cell reaction chiefly neutrophibic.	5. Periductal cell reaction chiefly monoculear.
6. No changes in blood vessels.	6. Swelling and hyperplasia of artiolar endothelium with occasional beginning annular thrombus formation.
If our original hypothesis were correct the following statements should also be true:	
7. Duct orifice swollen, red, pus present or able to be milked from duct.	7. Duct orifice normal in appearance or slightly reddened. Secretion normal.

* From the Department of Surgery, Binghamton City Hospital.

supervision of Custer.[6] The authors have definitely disproved the older theory of Rost that the pathological picture in acute parotitis is the same in both types of infection. In their experience also, ascending infection in the dog was easier to produce than hematogenous, a point which is of great interest. Seven of 10 were infected of the ascending type group while only 3 of 15 showed infection when the bacteria were injected into the parotid artery. A résumé of their findings is in order at this time.

In the article cited no mention was made of the appearance of the duct orifice during the experiment. Upon inquiry, Dr. R. P. Custer sent the following reply, of September 13, 1935, which we report verbatim with his permission.

In the experimental phase of the parotid work we observed the orifice of Stenson's Duct. The few glands infected by the blood stream route were not accompanied by an abnormal appearance. Those infected via the duct showed definite inflammatory changes of the orifice, i.e., swelling, redness and suppuration. These changes, however, may not be comparable to those of spontaneous human cases because it was necessary either to plug or ligate the duct to effect a take.

Referring again to Kamniker's[11] work, we note that a decline in the general condition and resistance to infection are the most important factors in ascending infection. Custer[6] produced infection in the healthy dog by plugging the orifice or by ligature. That the duct is plugged in the human cases by increase in viscosity of

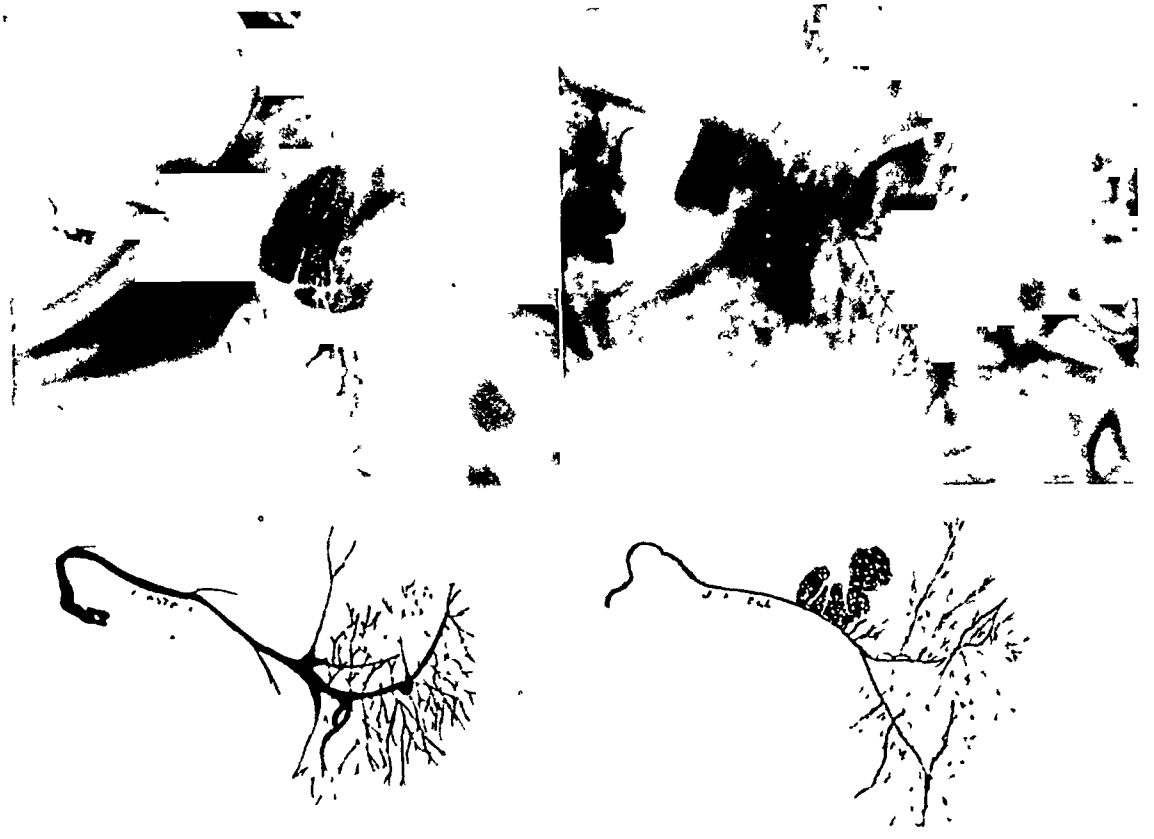


Plate I. Plate II.

Plate I. This shows normal duct and ductules with peripheral structure clear cut. The accessory gland is shown by fine ductules.

Plate II. This shows normal duct and ductules with peripheral detail well defined. The mass which presents in the area where accessory gland should be is due to imposition of injected pathological opposite gland which was not empty when this plate was taken.

saliva in ducts which are atonic and in tissues which have lost their power to repel bacterial invasion seems logical.



Plate III. This shows normal duct and ductules emphasizing the variability in caliber when injected. They are clear cut however and differ radically from the pathological ones to be shown later in the study. The accessory gland is well demonstrated by the vertical duct. The peripheral detail is not as well brought out as in Plates I and II.

The appearance of thick, tenacious, stringy saliva which is cleared from the mouth with difficulty is often seen in debilitated patients. A rather far fetched but interesting analogy is pulmonary atalectasis due to blocking of a bronchus by secretion when the cough reflex is impaired.

Talbot[20] in summing up the reasons for believing infection is usually of the ascending type states "most cases show clear evidence of infection of Stenson's Duct, pus being present at its orifice. Were the infection of hematogenous origin there is no reason to suppose that pus would appear in the duct at an early stage."

The predominance of ascending infection as a cause of parotitis is theoretically as well as practically evident. Lowering of local resistance, increased viscosity of saliva, etc., occur where parotitis is most often seen.[15]

The frequent presence of bacteria in the blood (*bacteremia*) is an accepted fact and under ordinary conditions is of little practical value. Menken[14] states that dye injected intravenously is rapidly accumulated in areas of previously prepared inflammation. Bacteria act in the same way, i.e., osteomyelitis following trauma. Accordingly, hematogenous parotitis would occur ordinarily only if the gland were previously affected in some way. It would have been instructive to see if more takes occurred when the glands were previously bruised. The possibility that rough handling of the gland by the anesthetist may play a part, as once suggested and later discarded, is therefore tenable. The apparent rarity of hematogenous infection is also understandable, and the result obtained by Custer[6] to be expected. In our opinion however, more cases of hematogenous infections of the parotid will be reported when they are examined and classified as we suggest.

TREATMENT

The treatment of acute cases cited by us previously, as hot or cold applications, massage of the gland, heliotherapy, *x*-ray and radium packs, as well as dilatation of Stenson's duct are still in vogue. The use of the radium pack as advocated by Rankin and Palmer[15] is at present the most used method when available. Coller and Yglesias of Ann Arbor use dilatation of the duct coincidently with the radium pack. The only new method of treatment which we found advocated was the use of Lugol's solution in large amounts.[13] The general doctrine that radical operation is indicated if no abatement of symptoms occurs in about three days is still widely accepted.

In reference to our treatment of acute cases there seems to be a misunderstanding. We used mercurochrome initially, but

stated that we had discarded this later in our studies. Apparently our later statements were overlooked. (Christopher—Minor Surgery.) We therefore feel that a description of our present technique may be of interest.

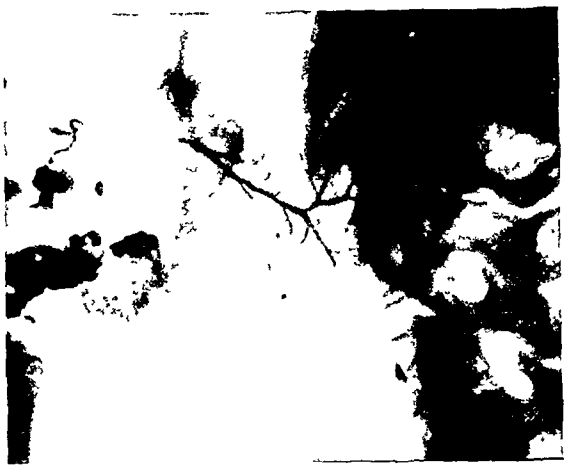




Plate iv.



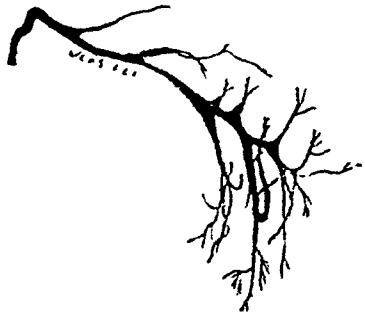


Plate v.

Plate iv. This shows clear-cut ducts and ductules, accessory gland and moderately extended peripheral detail. This patient had an attack of mumps in 1931, which was ushered in by pain and swelling of the right testicle. About four hours later there was swelling of the right parotid. He was hospitalized in one of the large Isolation Hospitals in Boston, Mass., where after intensive study a diagnosis of epidemic parotitis (mumps) was made. Convalescence was uneventful aside from atrophy of the testicle. It is evident that despite the severity of the infection the parotid gland recovered completely.

Plate v. This shows normal ducts and ductules, accessory gland and moderate peripheral detail. This patient had a bilateral parotitis with left orchitis and resulting atrophy of the left testicle. Like Plate iv the sialogram appears normal in every detail.

Comment. The plates shown above vary in appearance as would be expected. They however are considered normal inasmuch as the ducts and ductules are clear cut. The details of the periphery vary with the individual and also with the pressure of the injection. We do not feel that complete peripheral injection must be shown in order to make a diagnosis of a normal gland.

We omit injection of mercurochrome or any other irritating substances in the care of acute cases of the ascending type. We dilate carefully and then irrigate with normal saline. Fluids are forced and the patient is encouraged to open and close the mouth as much as possible, thereby causing a mild massage of the gland. In the future we also intended to use Lugol's solution at the same time. Theoretically this follows the lines used in pyelitis, i.e., lavage of the pelvis plus antiseptics by mouth. Use of bacterophage might be of value as an irrigating solution. The use of radium packs impresses us as being of the same value as their use in the treatment of acute infections elsewhere.

Perusal of the case reports cited in the literature was illuminating. When cultures were positive and the appearance of the orifice was noted, it was red, pouting and pus could be expressed. Since dilata-

tion was not done in any of the cases cited, the fairly frequent occurrence of suppuration was to be expected.[13,20] Since we have been doing this work, no breaking down has occurred when the dilatation and treatment as mentioned was consistently followed, even in fatal cases.

In the hematogenous type, the use of *x*-ray and radium packs would be the accepted procedure when possible. In our case, the use of cold and hot applications was accompanied by a cure. The use of Lugol's solution also may be of value. Dilatation is contraindicated.

Treatment of chronic infections was little mentioned in literature. Simon[16] uses "bougienage" or dilatation of the duct as we do. The use of radium packs would seem to us of questionable value as the pathology is due to inadequate drainage plus a low grade infection. The sialograms support this point. Lugol's solution by mouth at the same time is worth trying. In the treatment of chronic recurring parotitis, treatment is directed to obtaining free flow of saliva and stimulating the gland and ducts by infrequent gentle dilatation. Frequent rough treatments or the use of irritating solutions may aggravate the condition. Lipiodal seems to gently irritate the ducts in a favorable way.

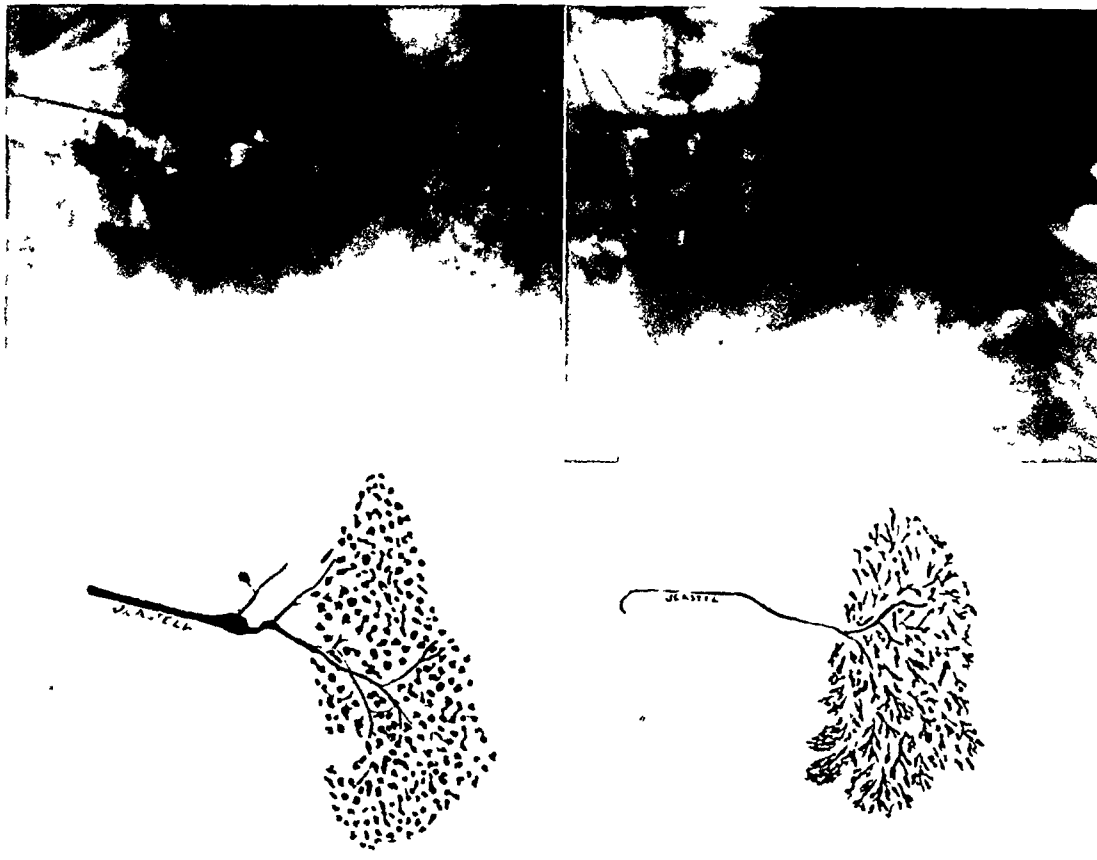


PLATE VI. PLATE VII.

SIALOGRAMS OF NORMAL GLANDS

(Shotlike Type)

PLATE VI. Case V. This is a sialogram of normal parotid gland. This patient had mumps in childhood, but has had no other trouble with the parotid gland shown. It is noted that the ductules end in irregular small dilatations. These can be noted only on close examination of the sialogram. In our previous report[10] we called attention to this type and referred to it as "shotlike."

PLATE VII. This is a normal gland in a patient who has had no trouble in this area. It is noted that there is some irregularity in the ducts and that the periphery shows a slightly more pronounced condition of terminal dilatation.

COMMENT. These sialograms are of parotids which have had no history of previous clinical trouble and therefore in the light of our present knowledge and despite their bizarre appearance we must consider them normal.

CASE REPORTS

Case I. Miss R., age nineteen years was seen April 6, 1932. This patient developed an acute parotitis on the third day following an appendectomy for acute catarrhal appendicitis. The inflammation was ushered in with a temperature of 103°. The left parotid was swollen and tender with pouting redness of the duct orifice. Pus was milked from the duct. This was dilated and irrigated with saline solution. Two days later the patient was free from fever. April 11, 1932 gland was normal in appearance.

Case II. Mr. E., age twenty-two years was seen June 5, 1934. Three days previously the patient had had a tooth extracted. Two days later there was sudden pain in the right parotid and temperature was 102°. The gland was swollen and tender, the orifice of the right duct was red and pouting and pus could be expressed. The duct was dilated and irrigated with saline for three days. The temperature dropped to 99° and the swelling subsided gradually. On June 15, 1934 there was complete subsidence of all signs and symptoms.

Case III. Miss E., age twenty years was seen May 9, 1935. The patient was operated for acute appendicitis April 29, 1935. Five days later the temperature suddenly arose to 104.2° with pain and marked swelling of the right parotid. The swelling was so intense that the skin was tense and shiny. The duct was red and pouting and after dilatation pus drained freely. May 12, 1935 her temperature was 98.3° and the swelling had subsided entirely.

Case IV. Mr. F. B., age sixty-two years was seen August 9, 1935. He was admitted to the Binghamton City Hospital in a critical condition with a gangrene of the little toe. The admission temperature was 104.3°, pulse 120, respirations 24. There was sugar in the urine and many granular casts. The patient was treated medically with some improvement. Amputation at the lower third of the right thigh under spinal anesthesia was done on August 14. The patient's condition gradually failed, his temperature ranging between 100° to 102°. August 21, 1935, there was pain and swelling of the left parotid which gradually became more marked. There was no change in the general condition, and no rise in temperature at the onset of the infection. The duct was dilated and irrigated with mercurochrome August 24, 1935. He also had a severe cystitis and right conjunctivitis. The temperature remained about the same until his death August 26, 1935.



SIALOGRAMS OF INFECTED PAROTIDS

(*Shotlike Type*)

Plate VIII. Case VIII. (Fig. 10 Original Report.)[10] This plate represents the appearance of a parotid three weeks after an attack diagnosed "mumps." Externally there was a faint swelling with tenderness to palpation. The duct orifice was normal.

The duct is essentially normal with shotlike appearance of periphery. This cannot be differentiated from normal Plates VI and VII.

Case V. Miss A. M., age eighteen years was seen July 6, 1935. The patient had a history of pelvic inflammation of three weeks duration. She had been treated with diathermy without relief. She showed a "frozen" pelvis with a mass filling the entire lower quadrant, palpable through the abdomen. She received several Elliott treatments without much relief, the last being July 19, 1935. This was given for thirty minutes at 115°. July 20, the patient complained of sudden pain in the left parotid region. Temperature was elevated slightly above the previous level. There was no chill. Orifice of Stenson's duct was slightly reddened but not enlarged or pouting and clear saliva

was expressed. She was given an iodine mouth wash and magnesium sulphate cold compresses applied. Because of pain and inability to open her mouth, she was not able to eat. A continuous clysis was given and sedatives were administered as necessary. Temperature gradually fell to 100° by July 23, and was normal by July 28. At this time the gland was not swollen, but tender on pressure. A lipiodal injection of the infected gland was made August 4, 1935 and of the opposite side August 5.

During the acute stage of the pelvis inflammation which coincided with the inflammation of the parotid gland, the patient had intense abdominal pain, much more than is usual in a pelvic inflammation. The Elliott treatments at first seemed to relieve this condition, but the last one made it definitely worse. There is a question in our mind whether the last treatment in some way liberated emboli, one or more of which ended in the parotid gland. However, she had no signs or symptoms of emboli elsewhere.



PLATE IX.



PLATE X.

PLATE IX. Case X. (Fig. 12 Original Report.)[10] This represents the appearance of a gland seen two months after an infection. At this time there was a marked tender swelling externally with an injected pouting duct. The secretion was thick and contained white flakes. Condition cleared up on dilatation and lavage.

The sialogram shows the shotlike appearance, but to a less marked degree. The duct seems normal.

PLATE X. This is a sialogram of Case V diagnosed "Hematogenous Infection." (Compare this with Plate VI which is the normal gland of the same patient.)

The duct is normal in appearance. The ductules show the pocketing seen in the previous plates. While a close comparison shows more marked pocketings in this, Plate VI looks nearly as pathological.

COMMENT. Examination of the five plates demonstrating shotlike appearance of glands shows that without a normal control, it would be impossible to tell which were abnormal. Plate VII and IX cannot be differentiated by the sialograms and yet they are clinically the opposite. Plates VIII and X are a little more on the pathological side and yet Plate VI shows essentially the same condition and also shows some abnormality of the duct (may be due to injection).

We therefore feel that the shotlike appearance of parotid glands does not mean either a normal or abnormal condition unless the clinical diagnosis corresponds. We also feel that this is not a sign of hematogenous infection as we had at first hoped. Further studies are necessary in order to establish the status of this sialographic entity.

Case vi. Miss G., age fifty-eight years was seen July 19, 1933. This patient developed a bilateral swelling of the parotid glands in February, 1933. This continued off and on until the date seen. At this time the temperature was normal, both glands were swollen, both duct orifices were red and pouting. The ducts were dilated on alternate days from July 19 to July 30, 1933. On August 12, 1933 both glands were normal in appearance and patient was free from pain.

Case vii. Mrs. T., age sixty-two years was seen September 2, 1933. This patient developed swelling of the right parotid in April, 1933. This condition was present off and on until seen. At this time the temperature was normal. There was diffuse swelling of the right gland with redness and pouting of the right orifice. She was dilated when seen and again September 7. October 1, 1933 the swelling was completely subsided and all symptoms relieved.

Case viii. Mr. B., age sixteen years was seen August 2, 1935. This was a case of mumps showing bilateral swelling with normal duct orifices. The duct was dilated on numerous occasions to see if the condition could be alleviated but no effect was noted. This last case is reported merely to emphasize the difference between ascending and hematogenous infection no matter what the organism. The result was as expected.



Plate xi.

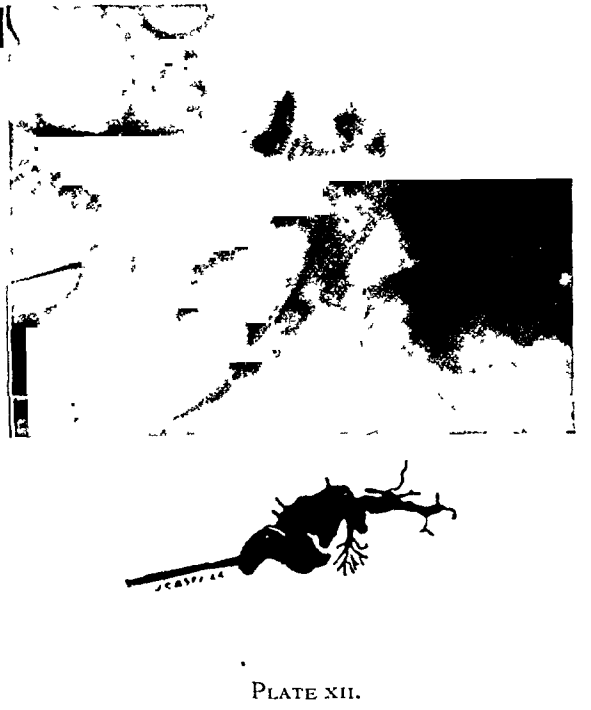


Plate xii.

ABNORMALITIES OF DUCTS OR DUCTULES

Plate xi. Case iv. (Fig. 6 Original Report.)[10] This represents a parotid with the history of a definite ascending infection. It was treated by dilatation with recovery.

It is noted that the pathology is mostly confined to the larger ducts. The size of the main duct may be attributed to the dilatation. The marked irregularity however, is undoubtedly caused by the infection.

Plate xii. Case ix. (Fig. 11 Original Report.)[10] This represents an infected gland of the ascending type, which had persisted with remissions for about one year. When seen the duct orifice was pouting and red and thick mucilaginous flakey secretion could be expressed. Dilatation and lavage resulted in a clinical cure. It is noted that there is a large dilatation of the duct. In the absence of calculi it is felt that a persistent low grade infection was the chief etiological factor. The peripheral detail does not show, but this is probably due to lack of sufficient lipiodol rather than to peripheral obstruction.

SUMMARY OF CASES

Five cases of acute inflammation of the parotid gland are reported. In 4 of these the criteria necessary to denote ascending type of infection were seen. Treatment in 3 resulted in prompt cures. One case was in a moribund patient where the infection of the parotid was but one factor in a general disintegrative process. We feel that the

mortality was unavoidable and that the parotid had little or no part in it.

In the remaining case, a diagnosis of hematogenous infection was made. This subsided with the application of cold compresses and later heat by means of a thermolite. The duct was very carefully left alone.

The case of mumps is not included in the above summary and is merely cited as a point of general interest.

Two cases of chronic inflammation of the parotid are reported which were treated by dilatation as indicated by the appearance of the duct orifice. Both cases were completely relieved.

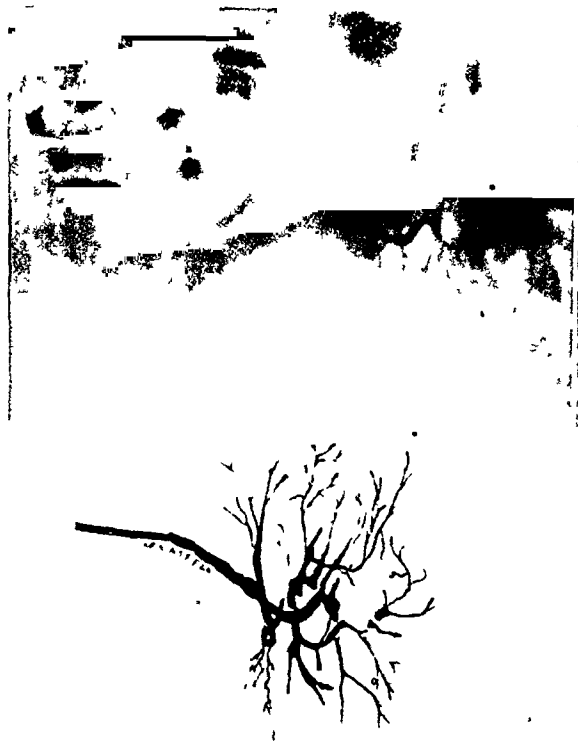


PLATE XIII.



PLATE XIV.

PLATE XIII. Case VI. (Fig. 8 Original Report.)[10] This represents an infected gland following an attack of grippe one year previously. The condition had recurred every few weeks during this time. Treatment by the usual methods was without relief. When seen there was slight swelling over the parotid with prominence of the duct orifice but no sign of acute inflammation. Normal saliva could be expressed from the duct. Dilatation resulted in complete clinical cure.

The sialogram shows dilatation and pocketing of the larger ducts. The peripheral detail appears normal. This plate clearly indicates the use of dilatation.

PLATE XIV. Courtesy of Dr. George W. Christiansen, Detroit, Michigan. This patient, a female, age fifty-five years developed a right parotitis seven years ago. This persisted to some extent during the entire interval. In March, 1935, she developed bilateral mumps followed by bronchitis and pleurisy. May 18, 1935, acute edema of the right parotid developed. This gradually decreased to a low grade inflammatory condition and was also accompanied by some inflammation of the left side. The ducts were dilated and mercurochrome instilled on several occasions with marked improvement of the left side and some improvement on the right side. There was still edema on the right side however, when last heard from the patient, October 15, 1935. Examination of the sialogram of the right parotid reveals a striking similarity to Plates XII and XV, being about midway between the two conditions. The use of dilatation was clearly indicated in this case as explained in our discussion of the treatment of chronic infection.

RESULTS

Statistics on such a small series are of no value. Our results speak for themselves. Before a true evaluation of this method can be made further study is necessary. At the present time however, we feel that our method of treatment is physiological and superior to any yet suggested.

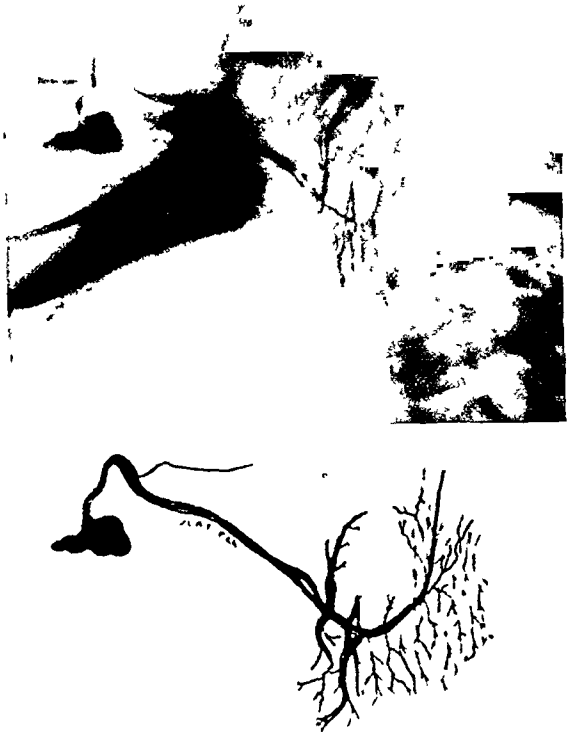
SIALOGRAPHY

Great interest has been manifested in the use of sialograms. Barsky and Silberman,[2] Kim, et al.,[12] Simon[16] and others have used this method of delineating parotid pathology and especially tumors. The technique has been essentially the same. Most writers stress the necessity of dilating the duct prior to injection. We only dilate the duct when necessary, as in very old patients with atrophy of the tissues. In none of the patients since our original series have we had to use dilatation. We use a blunt 22 gauge 2 inch needle.



PLATE XV. Courtesy of Dr. George W. Christiansen, Detroit, Michigan. This is the picture of the left parotid of the patient in Plate XIV. The evidence of previous infection with irregular dilatation of the ducts is well demonstrated. The reason for the more rapid clinical improvement as compared to the other parotid is to be expected from the pathology shown. This resembles Plate II and the results. These cases parallel each other.

COMMENT. Examination of the sialograms reveals the pathology which one would expect. Acute infections which subside immediately would show little or no pathology. Chronic infections, especially with acute recurring exacerbations produce demonstrable abnormalities in the size and outline of the main ducts, which are clearly delineated in the plates. It is striking that in those cases which were resistant to treatment, impediment to the outlet of saliva was always present. This resembles infection above a ureteral stricture.



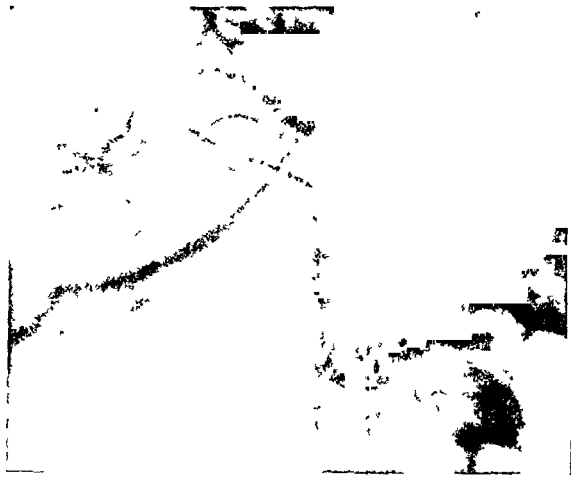
SIALOGRAMS OF TUMORS OF THE PAROTID

PLATE XVI. N. M., female, aged forty-five years, picture taken August 1, 1935. This patient had a mass just below and anterior to the left ear. It was round, firm and apparently embedded in the parotid gland. The skin was freely movable over the mass. The patient had had no trouble from this condition aside from the cosmetic effect. The sialogram shows a normal gland and ducts with a deformity in outline in the proximal part of the gland characterized by a pushing aside of the normal tissue rather than a break in the outline of them. This crowding is most marked superiorly and peripherally. A diagnosis of encapsulated tumor is evident. August 5, 1935, Dr. Charles D. Squires removed an encapsulated mass about an inch in diameter. The tissue was spongy, homogenous in character and shelled out very readily. Convalescence was uneventful except for a salivary fistula which closed after irradiation. No facial paralysis ensued.

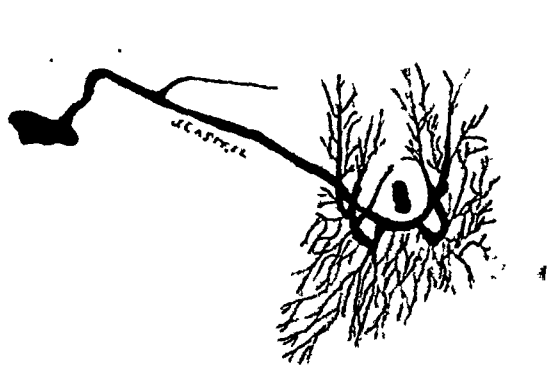
PATHOLOGICAL REPORT. Mixed tumor of the parotid. This should be compared with Plate I which is the sialogram of the normal parotid.

The operator stands on the side opposite the orifice (left side for right parotid and vice versa) with the patient lying on his back. The buccal mucous membrane is carefully dried and the duct orifice noted. The needle attached to the syringe con-

taining 1.5 c.c. of lipiodol can usually be passed 1 to 1½ inches without difficulty. Simon[16] states that an olive tip is necessary to prevent regurgitation. We always have a backflow into the mouth but have failed to visualize a gland in only one case. This occurred in one of the parotid tumors (Plate XXII) where the entire cheek was rigid from *x*-ray treatment. In this case the rigidity of the tissues was such that the angle of the mouth cracked and bled when the cheek was retracted enough to demonstrate the duct orifice. The needle was passed without dilatation being necessary, but pain was severe after 3 mm.







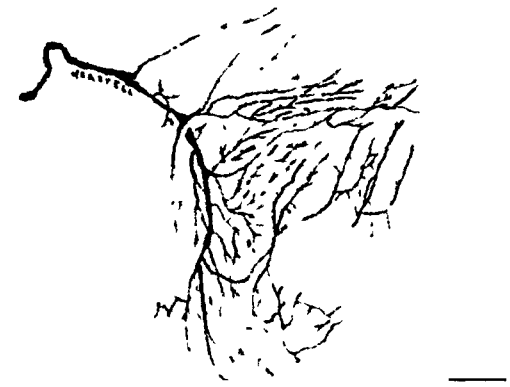


Plate XVII. Plate XVIII.

Plate XVII. August 29, 1935. This is the postoperative appearance of the gland demonstrated in Plate XVI. It is noted that the filling defect is less marked and that the normal appearance tends to return even at this short interval. The blob of lipiodol in the centre probably represents the point at which the normal tissue was cut. It is probable that the opening of the salivary fistula began at this point also.

Plate XVIII. J. C., male, age thirty-seven years was seen November 14, 1935. This patient developed a sudden swelling in the left parotid region during an attack of severe vomiting about seven months ago. This was accompanied by pain which only lasted a short while. The mass has persisted ever since and has caused no subjective or objective symptoms aside from the constant deformity.

Examination shows a round cystic mass just below the left ear, which seems adherent to the parotid gland, but which is movable. The overlying skin is free. The sialogram shows normal duct and ductules with peripheral detail well defined. At the extreme periphery there is a filling defect corresponding to the cystic tumor. The lattice work appearance caused by crowding normal ductules is well demonstrated. A diagnosis of encapsulated tumor seems indicated.

On operation, November 20, 1935, the tumor was found embedded deep in the gland requiring section of this before being seen. This was encapsulated and was readily enucleated by blunt dissection and with the finger. The capsule was adherent posteriorly and was broken through at this point. The tumor was about 1½ inches in diameter and consisted of a periphery of glandular tissue about ½ inch in diameter surrounding fluid which suggested an old haemorrhage. Convalescence was uneventful except for a salivary fistula which is being irradiated. No facial paralysis has developed.

Pathological Report. Mixed tumor of the parotid.

The solution is injected slowly, 1 or 2 mm. at a time. The patient feels fullness or pain as the solution enters, which subsides on cessation of pressure. When either a slight fullness of the gland occurs, or the patient complains, the injection is concluded. We have had no ill effects beyond a soreness which lasted from one to four hours. The intermittent injection permits more fluid and therefore better visualization. The needle is then withdrawn, the mouth carefully wiped free of



Plate xix.



Plate xx.

Plate xix. Postoperative appearance of gland in Plate xviii. Salivary fistula present.

The sialogram shows normal ducts, ductules and peripheral detail. The filling defect is still present but is smaller. Lipiodol rests show where the normal structure is broken and may point to the beginning of the fistula. It is noted that the ductules about this area visualize (permit entrance of Lipiodol better) than in the preoperative picture. This is best demonstrated at the lower part of the periphery.

Plate xx. R. S., male, age forty-seven years, seen October 17, 1935. This patient had symptoms referable to a slow insidous facial paralysis which took approximately eight months before being clinically recognizable. He had lost about sixty pounds during this time. He had no pain and no symptoms pointing to the parotid region aside from a small, hard, irregularly nodular mass below the ear and between the mastoid and the angle of the jaw. When seen the left facial paralysis was quite marked, with inability to close the eye. The tumor mass was so hard that a diagnosis of cartilagenous deposits in a mixed tumor of the parotid was made. The tumor seemed adherent to the underlying tissues and to the parotid. It was not movable nor tender. The overlying skin was free. The probability of malignancy was also considered. The sialogram shows normal ducts, ductules and peripheral detail. The distal lower portion shows an abrupt ending suggesting pressure. No filling defect in the gland itself is noted. At operation, October 29, 1935, a hard inflammatory mass was found, which was freed with great difficulty from the mastoid and parotid. This had apparently invaded the facial nerve and the surrounding tissue. The mass felt cartilagenous but on section did not look like cartilage. It was removed piece meal until the facial nerve was demonstrated at its exit from the foramen. It was impossible to tell whether this was intact or whether we had removed part of it since there was no reaction to stimulation peripherally. It was felt that the tumor was probably malignant. The patient's convalescence was uneventful. The facial paralysis has improved slightly, but the patient states that he feels much better, that he can close the eye better and that sensation is returning to the cheeks. From our operative findings we would expect little if any improvement. Pathological report from the laboratory at the Binghamton City Hospital and also from the Institute for Malignant Diseases at Buffalo, New York states that there is a chronic inflammatory reaction about a ganglion. The Wassermann is negative.

the solution, and the patient put in position and pictures taken. As suggested by Dr. B. Wulff of the *x*-ray Department of the Binghamton City Hospital, true laterals are taken and have been found to be satisfactory in every way. If bilateral films are taken, the duct injected is carefully milked before injecting the other. We have not done stereoscopic films as suggested by Kim, et al.[12]

Simon[16] uses 40 per cent iodipin and injects 2 to 5 c.c. Our plates demonstrate



PLATE XXI.

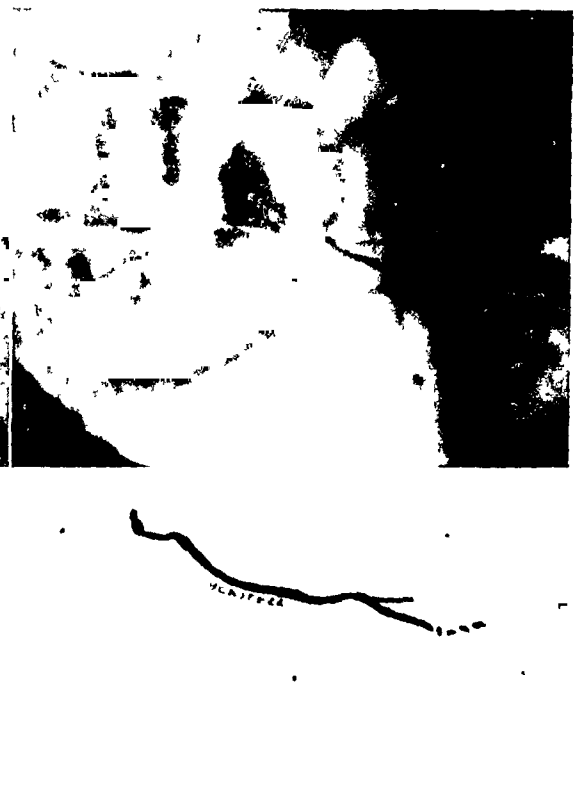


PLATE XXII.

PLATE XXI. R. R., male, age thirty-seven years, has had a tumor in the right parotid region for several years. He has had intensive *x*-ray treatment both at the Binghamton City Hospital and at Buffalo. When seen he showed marked induration of the parotid area but with no definite tumor present.

The sialogram shows a well developed, accessory gland. The ducts are normal. The glandular tissue presents a homogenous fluffy appearance unlike any other glands which we have previously seen. Comparison with Plate II which is the normal side, demonstrates clearly that there has been a marked change. No filling defect is noted, except possibly a slight distortion at the upper outer part. We are at a loss to explain this plate. We feel however that the tumor mass has probably invaded the gland. The *x*-ray appearance may be due to fibrosis caused by the irradiation. This is the first picture which we have taken which clearly shows the peripheral structure of the accessory gland.

PLATE XXII. F. D., male, age seventy-two years was operated in April, 1932, removing a squamous carcinoma of the skin just below the right ear. He remained well until 1934, when he began to have pain in that area and noted a swelling in the scar, which gradually enlarged. Examination showed a hard, rounded mass about an inch below the ear, firmly adherent to the overlying skin. It was considered to be a recurrence of the original condition and was excised November 8, 1934. At operation it was found that this tumor had involved the sternocleidomastoid muscle and the surrounding tissue. The mass was excised with as much normal tissue as possible, but it was felt that removal was not entirely complete. The parotid gland and facial nerve were not seen during the operation. The patient has received intensive *x*-ray treatment and at present the condition seems stationery.

PATHOLOGICAL REPORT. The tumor was a mixture of squamous cell epithelioma and mixed tumor of the parotid gland. The sialogram shows only the main duct. This is demonstrated not as a parotid tumor, but as an example of a case where there was so much scarring of the tissues that a proper injection could not be done. As stated before, only 3 mm. If lipiodol caused so much pain that injection had to be discontinued.

COMMENT. Our series of tumors is so small that it would not be fair to do anything but generalize. We agree with Kimm[12] and his associates that by means of sialograms it is possible to determine whether or not the gland is involved and the location and the extent of the involvement indicated. We must modify this last statement in view of Plate XXI by adding these words—"In the absence of intensive *x*-ray treatment."

that smaller amounts of lipiodol will suffice. This agrees with the other writers.

The comments on the value of sialography by various authors have been read by us with great interest. Interpretation of the films is admitted as being still unsettled. Our complaint has been that the detail which enabled the writer to make his diagnosis was often obscured in the publication. This is a fault which is referrable not only to sialograms. Because of this we take the liberty of submitting sialograms of normal and abnormal glands accompanied by silhouettes made from the film by Dr. John W. Castell of the Binghamton City Hospital staff. In this way it is hoped that the reader may visualize the details which may not be clearly delineated in the print. We feel that such a procedure if routinely used will aid in establishing definite criteria for future diagnosis.

SUMMARY

1. Review of current literature has been given presenting theories of the etiology of infections of the parotid gland.

2. Experimental proof together with clinical reports have been given showing that hematogenous infection of the parotid while uncommon does occur. It has also been shown that the two types of infection can be differentiated by clinical observation.

3. Further reports have been given on the use of dilatation of Stenson's duct in infections of the parotid of the ascending type.

4. Description of our technique in making sialograms has been given.

5. Sialograms of normal and abnormal glands including tumors have been shown accompanied by drawings representing the detail of the glands which is only seen on the original negative. We feel that further studies along the lines suggested is necessary before settling the questions involved in this paper. We also urge that further studies of sialograms which are published be accompanied by illustrations so that sufficient criteria be available to the reader for making definite diagnosis in those cases.

REFERENCES

1. Bailly, H. The salivary glands insofar as the mouth is concerned, *Practitioner*, 132: 651 (June) 1934.
2. Barsky, Arthur Joseph and Silverman, Henry. Roentgen visualization of the parotid gland by means of lipiodol injection. *Ann. Surg.*, 95: 46–51 (Jan.) 1932.
3. Bonmo, L. Postoperative parotitis, *Minerva med.*, Milano, 1: 319–324 (Feb.) 1930.
4. Berndt, A. L., Buck, R. and Buxton, R. Von L. The pathogenesis of acute suppurative parotitis—an experimental study. *Am. Jour. Med. Sci.*, 82: 5 (Nov.) 1931.
5. Combs, Charles N. Postoperative suppurative parotitis, *Anesthesia and Analgesia*, 7: 92–94 (March-April) 1928.
6. Custer, R. P. Acute suppurative parotitis—a pathologic and bibliographic study with report of two cases. *Am. Jour. Med. Sci.* (Nov.) 1931.
7. Fisher, William H. The treatment of postoperative suppurative parotiditis, *Annals Surg.*, 86: 445–448 (Sept.) 1927.
8. Foucault, P. Postoperative parotitis and its treatment, *Arch. med.-chir de Province*, Yours, 15: 58–65 (Feb.) 1925.
9. Gruenwald, Wilhelm. Is there a causative relation between postoperative parotitis and the rupture of sutures after abdominal operations? *Arch. f. klin. Chir.*, 178: 301 (Dec. 15) 1933.
10. Hobbs, William H., Sneierson, Hyman and Faust, Carlton L. Acute and chronic infections of the parotid gland—treatment by dilation of Stenson's duct. *Surg. Gynec. Obst.* (March) 1932; 54: 555–563 (Aug.) 1935.
11. Kamniker, K. Contribution to the knowledge of parotitis, *Der Chirurg*, 7: 45 (Jan. 15).
12. Kimm, H. T., Speis, J. W. and Wolff, J. J. Sialography, *Am. Jour. Roent. Rad.* (Sept.) 1935.
13. Leithauser, Daniel J., and Cantor, Meyer O. Lugol solution in acute secondary parotitis. *Annals Surg.*, 101: 5 (May) 1935.
14. Menken, V. Inflammation related to surgery. *Lancet* 228–981, 1935.
15. Rankin, Fred W. and Palmer, Bean M. Postoperative parotiditis—treatment without and with radium. *Annals Surg.*, 92: 1007–1013 (Dec.) 1930.
16. Simon, E. Diseases of the parotid gland in the röentgen picture. *Der Chirurg*, 6, 404–412 (June 1) 1934.
17. Stein, Irvin and Geschickter, Charles F. Tumors of the parotid gland. *Arch. Surg.*, 28: 492–526 (March) 1934.
18. Stewart, Calvin B. Management of parotid tumors. *Am. Jour. Surg.*, 30: (Oct.) 1935.
19. Stephanoff, N. M. The question of postoperative parotitis. *Permsky Med.*, f. 5: 91–96, 1927.
20. Talbot, Herbert S. Acute suppurative parotitis—its etiology, pathogenesis and treatment—*Am. Jour. Surg.*, 25: 2 (Aug.) 1934.

PREVENTION OF GAS PAINS

LOUIS E. MAHONEY, M.D., F.A.C.S.

LOS ANGELES, CALIF.

TO the patient who has undergone a surgical operation, the memory which is most distressing and persistent is that of abdominal distension, more familiarly known as "gas pains." Accounts of postoperative discomfort widely disseminated among the lay public have caused the postponement of many badly needed operations and numerous patients have succumbed without surgical treatment through fear of the pain and distress which have in the past been necessary concomitants of all abdominal operations. Any methods, therefore, which alleviate or entirely prevent these disturbing sequela are valuable additions to the surgeon's armamentarium and entirely worthy of serious study.

Before beginning the discussion of the means employed to prevent postoperative abdominal distension with its resultant chain of symptoms, a few words might not be amiss concerning the preparation of the patient and the choice of anesthetic.

In our experience ethylene and spinal anesthesia have proved most satisfactory. Both require the services of expert assistants and when for one reason or another such highly skilled associates are not available, ether administered through a face mask and by the open drop method is undoubtedly the safest drug for all around usage. Should ethylene fail to produce proper relaxation small amounts of ether may be used at intervals. With the proper selection of risks and in highly skilled hands, spinal anesthesia is as safe as any method in current use. We have never experienced any difficulty in its application, nor in a fairly large surgical experience do we have any personal knowledge of complications which could be fairly and truthfully ascribed to this procedure. From the technical standpoint, spinal anesthesia affords the best relaxation and is the most generally satisfactory agent for all abdominal surgery. Local anesthesia is eminently useful but requires assistants and nurses thoroughly trained for the purpose as the technique differs radically from general anesthesia. Nitrous oxide is mentioned only to be condemned as it depends for its effect largely upon anoxemia with resultant cyanosis and is extremely dangerous.

The proper mental attitude in the patient is quite important and in this particular field, the surgeon by his personality and management can do wonders to render the postoperative course smooth. A good night's rest before operation should be ensured by the administration of any hypnotic such as sodium amytal or neonal in suitable dosage. A preliminary hypodermic injection of morphine and atropine given one to two hours before going to the operating room will reduce the amount of anesthetic needed and check sweating, salivary, bronchial and intestinal secretion. Sodium amytal orally or intravenously in amount sufficient to dull the sensorium is very valuable in nervous individuals. No cathartics should be given before operation and if it seems desirable and necessary to empty the lower bowel, this is accomplished with least disturbance to the patient by a simple cleaning enema the night before.

It is, of course, assumed that the necessary surgical procedure will be performed in the gentlest fashion possible and with the minimum insult to tissues and in a reasonable amount of time. Probably excessively slow surgeons are as dangerous as are those individuals who sacrifice meticulous care in the interests of speed and brilliancy of technical maneuvers. Taking

for granted that the operation is well planned and properly executed, it may properly be asked what further steps can be taken to minimize postoperative discomfort.

In a surgical experience extending over more than a decade we have had occasion to participate as an assistant or as the principal in more than 1500 laparotomies in various hospitals and have been much interested in postoperative complications and their preventions. We have lavaged stomachs, prescribed enemata of sometimes fearful and wonderful compositions, used pituitrin eserine sulphate, atropine, hot stupes, heat cradles, etc., and have often felt that we were doing our patient more harm than good by the treatment. In our formative period, we served for the most part under surgeons who did not permit their patients to have water by mouth for twenty-four to seventy-two hours after the operation. On the third or fourth day, the usual hospital liquid diet, ordinarily tea, orange juice, lemonade, grape juice, milk, etc., was allowed and on the fifth to seventh or eighth postoperative day, the standard soft diet was ordered. Many surgeons did not allow a full tray, or so-called general diet, until just before the patient went home or even imposed rigid dietary restrictions for a considerable period during convalescence. Almost without exceptions, large amounts of normal saline or glucose solutions were given either subcutaneously or intravenously to the patient's great discomfort. Enemata of various sorts were prescribed so often to relieve the gaseous distention which invariably followed this type of management that private feuds developed between the patient and the nurse assigned to this thankless duty. All in all the postoperative course produced few pleasant memories and the wide publicity given these soul stirring and dramatic experiences has undoubtedly dissuaded many susceptible or fearful individuals from necessary and life saving operations. We have long felt that most of this suffering could be avoided, that much of this treatment was meddlesome if not downright harmful and have for ten years been evolving a system of postoperative management based upon the principles of normal physiology which renders the ordeal of an abdominal operation much easier for the patient to endure.

The human intestinal tract is a muscular tube, the mucous membrane of which secretes digestive ferments and the motility of which is largely dependent upon these ferments and the presence and character of the food material in the bowel. Activity of the liver, the chemical engine of the body, and the secretion of bile is greatly influenced by the amount and the variety of ingested food. Whenever starvation supervenes, and the usual hospital liquid diet is really semi-starvation, the bacteria normally present in the bowel increase enormously and produce large amounts of flatus. If lack of the food to which the upper bowel is accustomed continues for more than a very few hours, those species of bacteria normally resident in the colon and cecum ascend into the ileum and jejunum and there proliferate giving rise to huge amounts of gas and to symptoms of toxemia from absorption. So-called "autointoxication" is a widely recognized clinical fact, as witness the universal popularity of cathartic and the symptomatic relief so often afforded by their judicious use. Practically all successful medical treatments for colonic stasis appear to depend for their efficacy upon lowering or modifying the bacterial content of the colon. As long as these fecal bacteria are largely limited to the lower bowel, they are not of great importance but once they spread to and grow luxuriantly in the terminal ileum and jejunum, they become a fruitful source of trouble and produce a stormy postoperative convalescence.

The factors in health and normal well being which keep down the growth of these organisms are bile, the hydrochloric acid of the stomach and the digestive ferments powerfully aided by the peristaltic action of the bowel which endeavors to move the food taken in by mouth as far as the ileocecal valve in about six hours or less.

Necessarily if we add starvation, or semi-starvation in the form of the usual hospital "liquid diet," to the systemic shock of an abdominal operation, we are decreasing the secretion of hydrochloric acid, of bile and the digestive ferments, or perhaps abolishing temporarily these activities altogether and in addition markedly diminishing peristaltic action, thus favoring the multiplication of putrefactive and gas producing organisms and doing everything possible to produce abdominal distension in the mild case and adynamic ileus in the severe. A vicious circle is set into motion and the more gas formed, the less able the small bowel is to expel it owing to the unfavorable factors of excessive stretching and toxic absorption. Nature's effort to overcome this handicap consists of excessive and vigorous peristalsis, i.e. "gas pains." If for any reason whatever, peritonitis, inherently weak musculature, surgical shock, loss of body heat during the operation, too much anesthetic, etc., the small bowel becomes paralyzed and atonic with absent peristalsis, we have progressed from the stage of "gas pains" to that most dreaded complication, adynamic ileus.

It has long been taught that the best treatment for abdominal abscess is a quiet bowel and that peristalsis spreads infection and causes peritonitis. In contrast to this belief, we have felt that death due to general peritonitis was caused by intestinal obstruction produced by adynamic ileus rather than from absorption of toxins from the infecting organisms. A logical corollary to this view would direct treatment towards prevention of abdominal distension. Certainly to the practicing surgeon the most encouraging indication of improvement in desperate postoperative conditions is diminution of abdominal distension. Few of us worry much about a flat abdomen.

We recognize that these opinions run counter to the bulk of surgical teaching and to the beliefs of the majority of surgeons. However, the results in our efforts to restore the normal activities of the gastrointestinal tract immediately following operations have been so successful in more than 300 laparotomies for various pathologic entities that we feel no hesitancy in advancing them for the general notice of the profession. To observe a patient propped up in bed, with smile on his face eating with relish from a full tray on the morning after the removal of an acutely inflamed appendix is a thought-provoking spectacle. Briefly our method is about as follows with such modifications as may be made necessary by different conditions and varying temperaments.

Patients are urged to eat solid food very soon after operation, usually the next morning. If not nauseated, they are served a tray the evening of the operative day and encouraged to partake of dry toast, jello, cream of wheat and similar articles. Water is permitted by mouth in such amounts as the patient may desire as soon as the nausea has disappeared. When ethylene or spinal anesthesia has been employed, this is usually within one or two hours after the return from the operating room. Where ether has been used, water is ordinarily taken two to four hours afterwards. Sufficient morphine or pantopon is administered for the first two or three days to control pain. After the first night, some sedative of the barbital group is given for restlessness and to assist sleep and thus reduce the amount of opiate needed. Fruit juices of all varieties are strictly interdicted as it is felt that they have little or no caloric value and produce intestinal fermentation and resultant gas formation.

Besides the early feeding of water and solid food by mouth, it is also extremely helpful to supply some adjuvant which will furnish bulk, retard bacterial growth and thus help to combat intestinal stasis. This purpose is best served by mineral oil in agar, with or without the addition of phenolpthalein, and one ounce of this preparation is prescribed three time daily after meals. The bowels under this management will usually move on the third day and after action has occurred the dosage of the oil can be gradually reduced until it produces one or two actions daily without leakage. This daily or twice daily bowel

movement has important psychologic and physiologic results and the patient's feeling of well being is stimulated which reflects itself in increased cheerfulness with resultant good appetite. By the use of the oil and agar mixture, enemata may be almost entirely dispensed and the patients made infinitely more comfortable. The mucus normally secreted by the lower bowel has certain lubricant properties and the use of frequent enemata of soap suds or other chemical irritants, washes out this protective coating, slows down peristalsis, assists gas formation and thus defeats its own purpose. The administration of one enema thus calls for another and the patients rest is greatly disturbed and the convalescene lengthened. In the last 28 laparotomies performed I have had occasion to prescribe only two enemata and these were given to a patient who had been using mineral oil for severe constipation previous to the operation and it is highly probable that the amounts ordered were insufficient for this particular individual.

By permitting the early ingestion of water, forcing the feeding of solid food and adding a bulky ingredient to the feces which possesses lubricating properties, other beneficial side effects are obtained. Normal saline and hypertonic glucose solutions undoubtedly have a great field of usefulness but it is our personal conviction that these agents are employed far more often than needed following operative procedures and that frequently amounts are given which impose definite handicaps upon a critically ill patient. When water and solid food can be taken and retained, there is far less necessity for the administering of these fluids by the intramuscular, subcutaneous and intravenous routes. The pain arising from insertion of needles and the soreness resulting from the injection of large amounts of normal saline or glucose under the skin of the breasts, axilla or groin not infrequently is the source of more distress to our patients than is the site of the operation. Proctoclysis, or the giving of glucose and soda solutions per rectum has been practically discarded for the reason that absorption from the mucosa of the colon is very slow, and the early taking of water by mouth renders this mode of treatment entirely unnecessary.

Patients are encouraged to move about in bed as much as possible and to help themselves in every way as it is thought that early muscular activity promotes peristalsis and possibly might help to prevent the formation of adhesions. Needless to add, the mental effect on a patient when he or she finds that they are not entirely dependent upon the nurse is excellent and is reflected in increased cheerfulness, better appetite and quicker recovery.

Another interesting side effect of the treatment outlined is the fact that not as much weight is lost as when the older, standard methods are employed. Ordinarily a loss of anywhere from ten to twenty pounds is expected after an abdominal operation but with this regime, this figure can be greatly lessened, in fact, so much so, that frequently two weeks after their surgery has been performed many patients will have been found to have regained weight to within five pounds of the figure approximated when they entered the hospital. This naturally assists in the earlier return to an useful economic life.

As can readily be seen, the regime described is extremely simple and avoids unnecessary treatments and fussing with patients. We have often observed that saline injections, enemata, etc., have been ordered by attending surgeons when a little nap for the patient and a book to keep the nurse occupied would have accomplished a great deal more. In this connection, it might be remarked that nurses require careful instruction as from past training, they are likely to feel that they are not doing their full duty unless kept very busy. Tact, kindliness without oversentimentality and the avoidance of discussions by visitors of their terrible sufferings and dreadful "gas pains" will do wonders to keep your patient in the right frame of mind and amenable to your directions.

We fully realize that many of the ideas expressed run counter to the surgical teachings of the last twenty-five years and to the usual practices of the present day, but in our hands these methods have resulted in a very low mortality rate and in short, uneventful convalescent periods. With the single purpose of advancing the art and science of surgery through bedside, clinical research, we earnestly present these methods to the profession for consideration and study.

SUMMARY

Gas pains are the most distressing postoperative complication. Proper preparation of patient and extremely gentle operative manipulations are very important.

Ordinary postoperative treatment and usual dietary regime predisposes to gas formation. Hospital liquid diet is semi-starvation and causes proliferation of putrefactive and gas forming bacteria. Liquid diet is to be avoided and water and solid food given at once. Mineral oil is prescribed and enemata avoided.

The result is good appetite, no gas pains, bowel movement on the third day, very little loss of weight and earlier return to work.

REFERENCES OF DR. TRUESDALE'S ARTICLE*

24. Morrison, L. B. *Jour. Am. Med. Assn.*, 84: 161 (Jan. 17) 1925.
25. LeWald, L. T. *Radiology*, 3: 26 (July) 1924.
26. Akerlund, A., Öhnell, H. and Key, E. *Acta radiol.*, 6: 1, 1926.
27. Anderson, C. C. *Radiology*, 14: 602, 1930.
28. Anders, H. E. and Bahrmann, E. *Zeitschr. f. klin. Med.* 122: 736, 1932.
29. Bársony, T. *Fortschr. a.d. Geb. d. Röntgenstrahlen* 38: 629 (Oct.) 1928.
30. Berg, H. H. *Schweiz. med. Wchnschr.*, 48: 60, 1930; *Röntgenpraxis*, 3: 10, 1931.
31. Bock, A. V., Dulin, J. W., and Brooke, P. A. *New England Jour. Med.*, 209: 615, (Sept. 28) 1933.
32. Brown, H. P. *Surg. Clin. N. A.*, 9: 1191 (Oct.) 1929.
33. Brown, S. *Jour. Exper. Med.*, 11: 520 (Dec.) 1930.
34. Harrington, S. W. *Jour. Am. Med. Assn.*, 101: 987 (Sept. 23) 1933.
35. Hedblom, C. A. *Ann. Int. Med.*, 8: 156 (Aug.) 1934.
36. Hurst, A. F. *Jour. Am. Med. Assn.* 102: 585 (Feb. 24) 1934.
37. Jacob, F. *Schweiz. med. Wchnschr.*, 64: 104 (Feb. 3) 1934.
38. Lafield, W. L. *Yale Jour. Biol. and Med.* 3, 1930.
39. Lake, N. C. *Brit. Med. Jour.*, 2: 331 (Aug. 18) 1933.
40. Löw-Beer, A. *Röntgenpraxis*, 6: 818 (Dec.) 1934.
41. Moore, A. B. *Jour. Am. Med. Assn.*, 94: 12, 1930.
42. Moore, A. B. and Kirklin, B. R. *Jour. Am. Med. Assn.*, 95: 1966 (Dec. 27) 1930.
43. Neumann, R. *Virchows Arch. f. path. Anat.*, 289: 270, 1933.
44. Rigler, L. G. and Eneboe, J. B. *Jour. Thoracic Surg.*, 4: 262, 1935.
45. Robins, S. A. and Jankelson, I. R. *Jour. Am. Med. Assn.* 87: 1961 (Dec. 11) 1926.
46. Roch, M. *Presse méd.*, 42: 1651 (Oct. 20) 1934.
47. Schilling, K. *Fortschr. a.d. Geb. d. Röntgenstrahlen*, 37: 165 (Feb.) 1928.
48. Stadtmüller, F. *Ztschr. f.d. ges. Anat.*, 1: 188, 1925.
49. von Bergmann, G. *Deutsch. med. Wchnschr.*, 58: 605, 1397, 1932.
50. Wagner, A. *Acta radiol.* 13: 466, 1932.
51. Sauerbruch, F. *Deutsch. med. Wchnschr.*, 58: 1714, 1932.
52. Dunhill, T. *Brit. Jour. Surg.*, 22: 475 (Jan.) 1935.
53. Koppenstein, E. *Röntgenpraxis* 2: 31, 1930.
54. Richardson, E. P. *Surg. Gynec. Obst.*, 49: 129 (Aug.) 1929.
55. Ritvo, M. *Jour. Am. Med. Assn.*, 94: 15 (Jan. 4) 1930.
56. Gardner, K. D. *Am. Jour. Med. Sci.*, 185: 561, 1933.
57. Nissen, quoted by Jacob (ref. 37).
58. Fato. *Bull. et mém. Soc. radiol. méd. de France*, 54: 100 (March 12) 1912.
59. Frank, L. *Ann. Surg.*, 71: 280, 1920.
60. Darvall-Barton, J. A. B. *Brit. Med. Jour.*, 1: 767 (June 21) 1919.
61. Jopson, H. J. *Trans. Am. Surg. Assoc.*, 38: 624, 1920.
62. Mann, A. T. *Minn. Med.*, 6: 285 (May) 1923.
63. Fischer, A. W. *Arch. f. klin. Chir.*, 178: 274, 1933.
64. Olmstead, H. C. *Northwest Med.*, 27: 169 (April) 1928.
65. Gibson, F. S. *Jour. Am. Med. Assn.*, 93: 1719 (Nov. 30) 1929.
66. Postempski, P. *Bull. dr. Acad. med. di Roma*, 15: 191, 1888–89.
67. Eppinger, H. *Notnagels Handbuch*, Suppl. 1, Vienna, 1911.
68. Hinz, quoted by Fischer (ref. 62).
69. Stanbury, W. S. *Am. Rev. of Tuberc.* 29: 528 (May) 1934.

*Continued from p. 216.

FRACTURES OF SHAFT AND NECK OF FEMUR*

REPORT OF 119 CASES

IRWIN E. SIRIS, M.D. AND C. JOSEPH DELANEY, M.D.

Associate Visiting Surgeon, Bellevue Hospital; Attending Surgeon, Beth-Moses Hospital, Brooklyn

BROOKLYN, N. Y.

Assistant Visiting Surgeon, Bellevue and Willard Parker Hospitals; Jr. Assistant Visiting Surgeon, Knickerbocker Hospital

NEW YORK, N. Y.

THIS study comprises the results of 119 cases of fractures of the femur including 4 of the neck which were admitted to the Children's Surgical Service in Bellevue Hospital during the six year period, January 1st, 1930 to December 31st, 1935. The analysis includes the age, type and location of the fracture, radiographic findings, method of treatment and the observations made in our return clinic.

During the past six years the Russell method of suspension and traction in the treatment of fractures of the femur has gradually supplanted the generally accepted procedures of the plaster spica and continuous adhesive traction for children older than six years of age and to some extent the Modified Bryant's Overhead Pulley suspension for those under six years as previously recorded by Burdick and Siris.[1] Soon after the Russell method of treatment of fractures of the femur was introduced on the service the procedure was endorsed because of the simplicity of its application and the generally good results in alinement of the fragments and early restoration of normal function. This improvement in results can be attributed partially to the ambulance surgeon's obligatory application of a Thomas splint to the fractured extremity during transportation to the hospital. This method of procedure has resulted in satisfactory and frequently excellent anatomical reposition of the fragments, early proliferation of callus, firm union, without any appreciable delay in return of movement in the knee or hip or atrophy of the muscles.

AGE

The comparative frequency of fractures of the femur in various ages is enumerated in Table 1, where attention is also drawn to the methods of treatment employed and to the frequency of the application of Russell Traction in extremely young chil-

TABLE 1

AGE INCIDENCE AND METHODS OF TREATMENT

Bryant's Overhead Pulley Suspension		Russell Traction	
Age	No. Cases	Age, Years	No. Cases
7 months	1	2½	1
9 months	3	4	2
10 months	1	5	14
1 year	4	6	18
2 years	6	7	8
3 years	8	8	14
4 years	5	9	7
5 years	2	10	1
		11	4
Total	30	12	3
			72

Plaster Cast and Traction		Russell Traction Followed by Plaster Cast		
Age Years	No. Cases	Age Years		No. Cases
6	2			
7	3	5	7 days in Russell Traction then P.C., Poliomyelitis	1
7—refractured 12 weeks cast	1			
8	2	[10]	10 days in Russell Traction then P.C., Vaginitis	1
10	3			
11	2			
12	2			
Total	15	Total		2

* From the Children's Surgical Service, Bellevue Hospital.

dren. The youngest child was two and one-half years of age, 43 children were under eight years of age, 2 were four years old, 14 were five years old, 18 were six years old and 8 children were seven years of age. The excellent results obtained in children between the ages of eight and twelve years, by means of Russell Traction, suggested its application in younger children, particularly so because of the persistence of overriding in many of the fractures treated by the Modified Bryant's Overhead Pulley Suspension.

TYPES OF FRACTURE

Two of the 119 cases of fracture of the femur were compounded, and three children sustained fractures of both femurs. In Table II is shown the types of fractures

TABLE II
TYPE OF FRACTURE OF FEMUR

	Total Number of Cases	Type of Cases Treated by Russell Traction
Transverse (impacted 1)	56	30
Oblique (comminuted 15)	32	20 9
Spiral (comminuted 8)	31	22 8
Total	119	72

in the entire series and the number of each group that were treated by means of Russell Traction; of these 30 or 42 per cent were transverse, 20 or 28 per cent were oblique and 22 or 30 per cent were spiral. Eight of the spiral and 9 of the oblique fractures were comminuted.

LOCATION OF FRACTURES

In Table III is enumerated the frequency of the various positions of the fragments as they appeared in the different locations of the femur. There were 4 fractures of the neck of the femur, one was subcapital and 3 were transcervical. It is of interest to note the extraordinary resistence to injury of this part of the bone in children. Attention is called to the ability of a child with the subcapital fracture to continue to walk for two weeks before becoming disabled. (Case IX.) The 72 children with fractures of the femur that were treated by Russell Traction includes 2 or 3 per cent of the neck, 14 or 19 per cent, of the upper third of the shaft, 46 or 64 per cent of the middle third, 8 or 11 per cent of the lower third, and 2 or 3 per cent of the supracondylar region, (Case XI, Figs. 1 and 2). No fracture or separation of the lower epiphysis of the femur was encountered in this group and only one case has been recorded in the last fifteen years on this service.

TABLE III
LOCATION OF FRACTURES

All Fractures		Fractures Treated by Russell Traction
Site	No. Cases	No. Cases
Neck of femur	4	2
subcapital 1		
transcervical 3		
Greater trochanter	1	
Upper third	20	14
Middle third	68	46
Lower third	19	8
Supra condylar	5	2
Lower epiphysis	0	
Condyles	2	
Total	119	72

DISPLACEMENT OF FRAGMENTS

It is a significant fact that on admission to the hospital there was relatively no displacement of the fragments in 14 or 19 per cent of the 72 cases treated by the Russell Traction. Of these one child sustained a fracture in the upper third of the femur, 10 in the middle third and 3 in the lower third. This lack of displacement can be attributed to the obligatory application of the Thomas splint before transporting the patient from the site of accident to the wards.

Fractures of the shaft of the femur showed no uniformity in displacement. (Table IV.) Though muscle contracture and gravity are dominant factors in causing posterior displacement of the lower fragment, no characteristic displacement was noted except when a spicule of bone prevented further forward displacement of the lower fragment. This observation is at variance with the conclusions drawn from the group reported previously.[1] We attribute this lack of uniformity in displacement to the various directions in which the force of the trauma was expended in each individual case and to the proper application of the Thomas Splint at the scene of the accident. This first aid treatment undoubtedly prevented compounding in some cases and frequently realined the displaced fragments before the patient was admitted to the hospital. The seemingly good end results regardless of the method of treatment is to a great part attributed to the application of the transport Thomas Splint.

In all of our cases radiographic examinations were made immediately after the admission of the patient with the extremity immobilized in the Thomas Splint; the extent of the overriding was determined and the measurements of the extremities were recorded.

TABLE IV

DISPLACEMENTS OF FRAGMENTS OF CASES TREATED BY RUSSELL TRACTION

	Upper Fragments			Lower Fragments		
	Upper 3rd	Middle 3rd	Lower 3rd	Upper 3rd	Middle 3rd	Lower 3rd
No displacement	1	10	3	1	10	3
Posterior		1		3	15	2
Internal	4	4	1	6	11	3
External	5	11	3	4	4	1
Anterior	3	15	2		1	
Posterior and inward			.	1	3	
Posterior and external			.		5	
Anterior and external	1	3				
Anterior and inward		5				
Total	14	49	9	15	49	9

TREATMENT

1. *Modified Bryant's Overhead Pulley Suspension.* Formerly all children with fractures of the femur up to and including six years of age were suspended in the Modified Bryant's Overhead Pulley Suspension to both lower extremities. During the past six years 30 children under six years of age have been treated by this method. Although the procedure has had wide application and the results have been excellent, we have been disappointed frequently because of the failure of this method to improve the position of the fragments, for in no case did the position of the fragments become altered through the period of traction. In no instance was the overriding of a transverse or oblique fracture changed during the period of suspension irrespective of the region of the thigh to which the skin traction was applied. In our early cases the skin traction was begun at the upper end of the lower fragment. We then resorted to the application of the skin traction to the extreme upper end of the thigh as advocated by Hey Groves. His theory is based on the assumption that the combined pull of the skin, fascia and muscles as a tube will effectively exert traction and correct the position of the lower fragment. However this did not

meet with any more success in our hands than the first method, for the position of the overriding fragments remained unaltered

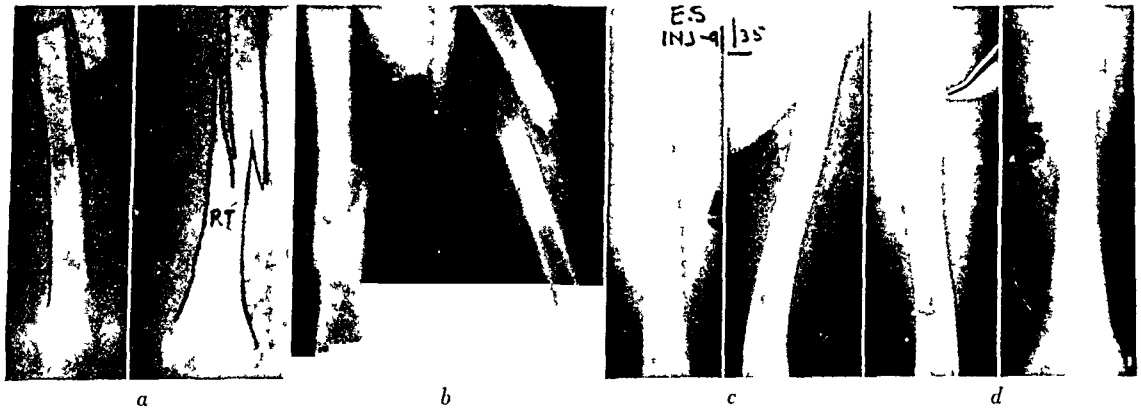


a *b* *c* *d* *e*

Fig. 1*a* and *b*, Case V. S. McG., nine years old, transverse fracture of right and left femurs. March 18, 1932, treated by Russell Traction *c*, 1 month later. *d* and *e*, 2 years and 8 months later, no shortening, perfect function.

during the period of suspension in both series of cases. The application of the adhesive traction to the proximal region of the thigh by its application to a greater skin surface has continued because it has obviated the frequent changing of the adhesive and it has been found to more

tween the ages of seven and twelve years with fractures of the femur were placed on a Hawley Table and with the aid of a general anesthetic an attempt was made to aline the fragments by manipulation. Adhesive traction was then applied to the skin beginning at the upper end of the extremity and a plaster cast was applied to the limb extending from the lower thorax to the ankle. The patient was



a *b* *c* *d*

Fig. 2*a*, Case VI. E. S., six years old, transverse fracture of left and comminuted fracture of right femur, September 11, 1934, treated by Russell Traction *b*, Two months later. *c* and *d*, One year and three months later, no shortening, perfect function

adequately adhere to the contour of the leg. Bryant's Overhead Pulley Suspension has a definite indication in the treatment of fractures of the femur in children under four years of age, because satisfactory position can be obtained in this group if sufficient weight is applied to keep the pelvis well off the mattress and the traction is not interrupted during nursing.

2. *Plaster Spica Cast with Continuous Skin Traction.* Formerly all children be-

placed in an adult bed. The traction was continued over the foot of the bed which was elevated. At the end of six weeks the plaster cast and traction were removed. Not infrequently what appeared to be a satisfactory alinement of the fragments after reduction was found on subsequent radiographic examinations to be completely altered (Case XII, Fig. 1, 2, 3, and 4). This change we attributed to the shrinkage of the thigh from the absorption of the

extravasated blood thus removing adequate support to the fragments. This often necessitated a second attempt at reduction and application of another cast. However this second attempt at reduction was rarely successful. Though the continuous adhesive traction often prevented further overriding of the fragments we have never seen it correct overriding that existed when the plaster was applied. Any shortening of the extremity that might be present on discharge of the patient from the hospital was generally overcome by growth within two to three years and in most cases the functional results were good. We were however of the opinion that the anatomical alinement of the fragments of cases treated by this method might be improved upon.

3. *Russell Traction and Suspension.* Cases of displacement of the fragments treated by Russell Traction was not as pronounced as was encountered in those treated in a plaster spica or in the Modified Bryant's Pulley Suspension. It must however be admitted that complete anatomical reposition of the fragments was not obtained in even a third of the patients treated by Russell Traction, but in these cases the long axis of the bone fragments was more adequately obtained and retained by this method of unencumbered traction.

The orthodox procedure as recommended by Russell[2] cannot always be sustained in the case of children for we have not been able to continuously maintain the angles of traction and the pillow in their proper positions. No sooner is the angle of traction adjusted than the child is found to slide forward, so that the pulley which should be directly over the upper third of the leg is generally found to be over the patella. The proper angle of traction from under the knee is often maintained from seven to fourteen days, during which period callus has begun to form which fixes the fractured surfaces together and therefore allows the child to change position without pain. As soon as this occurs the angle of vertical traction becomes altered. The change in this angle of traction is not of great importance in children as direct vertical traction over the knee is equally effective. It is recommended that an adult bed be used in the case of children so as to minimize any likelihood of the foot spreader coming in contact with the foot of the bed and thereby interrupting the traction on the leg.



Fig. 3a. Case VIII M. W. eight years old, transcervical fracture of the neck of the right femur, September 28, 1933. *b*, January 20, 1934. *c*, March 21, 1935. *d*, December 7, 1935, no shortening or disability.

When Russell Traction has been used the callus has usually been found to be exuberant. Early evidence of excessive callus in cases of oblique or spiral fractures results in earlier union because of the greater fracture surface. In transverse fractures where the cortical surfaces are in contact and particularly in those having slight displacement the fracture line is soon surrounded by a ball of callus. In very young children in whom periosteal stripping could be detected by *x*-ray examination, within three or four weeks the proliferation of callus was found to extend along the under surfaces of the periosteum around the fractured ends across to the opposing fragments.

Each of these procedures of treatment has had wide application. The Modified Bryant's Overhead Suspension in the treatment of fractured femurs has advantages in very young children and because of its simplicity and effectiveness it is the treatment of choice in those under four years of age. Formerly we included in this group of children treated by Bryant's Traction those up to and including six years of age. We are now however of the opinion that less overriding of the fragments and less shortening will result if children from four to six years of age are treated by Russell Traction. Further we are of the opinion that (1) Russell Traction should replace the adhesive traction and plaster spica cast for older children because it is a simpler procedure and is more efficient. (2) Through the action of Russell Traction the combined traction on the leg from below the knee and the 35° obtuse angle traction from behind the knee, with weights varying from five to ten pounds, will effectively bisect the two lines of traction and by so doing influences the elasticity of the muscles which have their

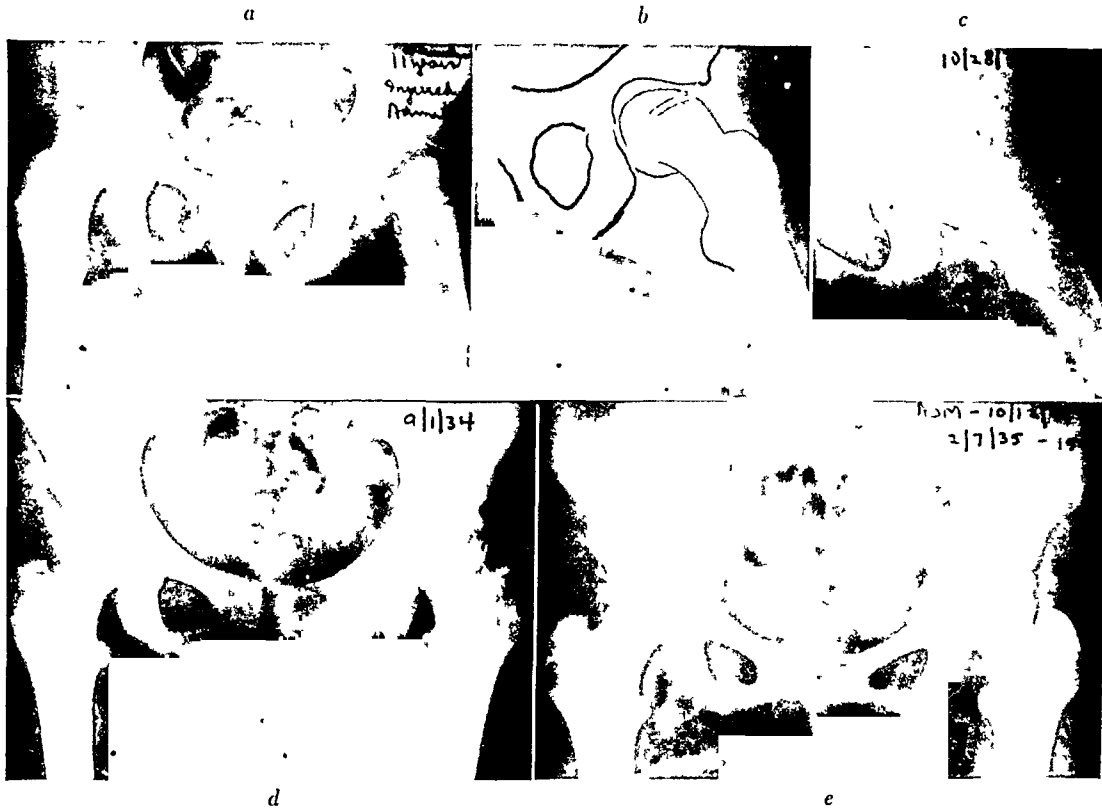


FIG. 4*a*, Case IX. S. W., eleven years old, subcapital fracture of the neck of the right femur, October 18, 1931, treated by Russell Traction. *b*, October 23, 1931. *c*, October 28, 1931. *d*, September 1, 1934. *e*, December 7, 1935, four years and two months after injury, no shortening or disability.

origin in the pelvis and are inserted into the tibia, thereby overcoming their pull and allowing the traction to be exerted upon the bone in its long axis. (3) As postulated by Russell, complete physiological rest of the muscles of the extremity are obtained with restoration of their equilibrium by extending the muscles to their normal length, which with the absence of interposed muscle or bone will allow the fragments to assume their normal position. (4) It permits a considerable range of motion at the knee and hip with less likelihood of muscular atrophy. (5) There is an early deposit of exuberant callus because the fractured surfaces and periosteum are irritated by the constant motion which is inevitable even though its range is small. (6) Union invariably results with the long axis of the bone in proper alinement though perfect anatomical reposition has not always been obtained. (7) Ultimately there is never any impairment of function, which is the objective.

Besides this the patients are found to be extremely comfortable in Russell Traction. Nursing, particularly the changing of linen and attention to the patient's wants, are accomplished with greater facility than when lying in a plaster cast.

PERIOD OF DISABILITY

The recuperative power and the rapidity of the reparative processes of growing children is extraordinary. The pain, impairment of motion and muscle atrophy is soon overcome as shown by the disappearance of weakness in the knee.



a *b*

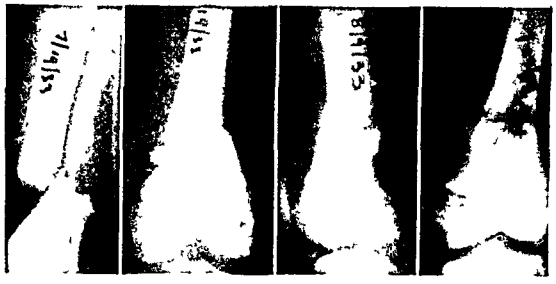
FIG. 5*a*, Case x. F. D., seven years old, transcervical fracture of the neck of the femur, treated by Russell Traction. *b*, September 10, 1935.

There was practically no limitation of motion of the hip or knee joints in any of our cases of fracture of the shafts of the femur when the children were discharged from the hospital. In the majority of these irrespective of the method of treatment the children were up and about the ward by the eighth week or sooner. Mobility of the knee and hip was rarely impaired even after the application of a plaster spica and traction. With the latter method some of the children were reluctant to walk at first but generally by the end of the tenth week their limp was gone and by the third month there was no impairment of function.

SHORTENING OF FRACTURED EXTREMITY ON DISCHARGE

Twenty-two or 73 per cent of the 30 children treated by Bryant's Modified Overhead Pulley Suspension presented no shortening and 3 children or 10 per cent had evidence of 0.5 cm. shortening when they left the hospital but this was not present at the end of a year. One child or 3 per cent had a 1 cm. and another 3 per cent had a 1.5 cm. shortening, in both of these cases at the end of a year no appreciable evidence of inequality could be determined. In one case, or 3 per cent, with

a shortening of 1 cm. and in another, or 3 per cent with a 2 cm. shortening, it was two years before the extremities were of



a *b*

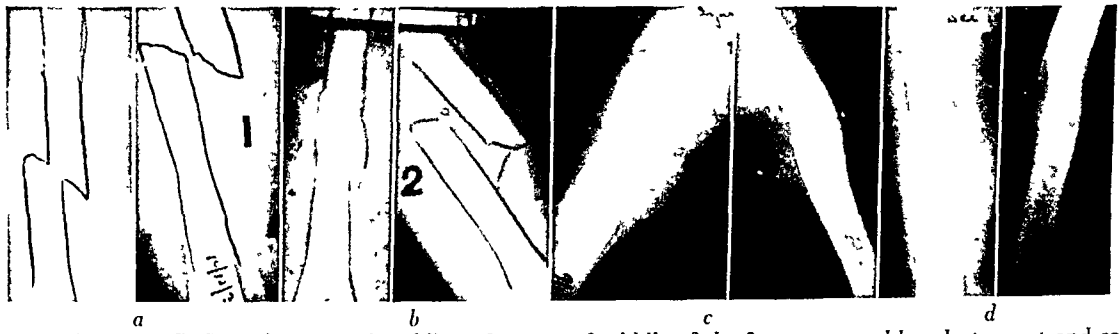
Fig. 6*a*, Case xi. L. C., supracondylar fracture of femur, July 19, 1933. *b*, August 9, 1933, twenty days after reduction with Russell Traction.

equal length. A child with poliomyelitis complicated by a fractured femur presented 2.5 cm. shortening which persisted for two years.

In this series of 119 fractures, 15 children or 12 per cent were treated by Plaster Spica Cast and Continuous Adhesive Traction, in 9 of these or 60 per cent, there was no inequality in length of the limbs on discharge from the hospital. One child each with 0.5 cm., 1 cm., 1.5 cm. and 2 cm. shortening overcame these inequalities within two years. In one case with 2 cm. shortening it took three years before the difference in length of the limbs was no longer evident. A child with a compound fracture of the neck of the femur with 0.5 cm. shortening on discharge showed persistent evidence of this at the end of two years and five months. One case in this group could not be traced, this child had a 2 cm. shortening when she left the hospital.

Thirty-nine or 54 per cent of the 72 children treated by Russell Traction were discharged from the hospital without any evidence of inequality of the lower extremities. There was no difference in measurement of the extremities at the end of one year in 11 children or 15 per cent with 0.5 cm. and 10 children or 14 per cent with 1 cm. shortening. It required two years to overcome 0.5 cm. difference in one child and 2 cm. in another. In one child it was three years before there was no evidence of residual shortening.

There were 2 children whose fractured femurs were placed in Russell Traction and after several days they were changed into a Plaster Cast with Traction. The oldest child was ten years and was admitted with the extremity in a Thomas Splint, the fragments being in good alinement but after placement in a Russell Traction the position of the fragments changed considerably. At the end of fifteen days traction was removed and the patient was placed on a Hawley Table where another attempt at correction was made. This was unsuccessful because considerable soft callus prevented the coaptation of the ends of the bones. Skin traction and a plaster spica cast was then applied and maintained for six weeks. At the end of



a *b* *c* *d*

Fig. 7*a*, Case xii. P. I., eight years old, oblique fracture of middle of the femur; treated by plaster cast and continuous adhesive traction, October 10, 1930. *b*, November 2, 1930 fragments slipped within the plaster cast. *c*, September 15, 1934 beginning restoration of contour of femur. *d*, December 14, 1935, five years and two months after injury, no shortening or disability.

this period the fragments were found to be firmly united and the boy was discharged with only a 0.5 cm. shortening and no other impairment of function. We were unable to follow the case. The other child was five years old, with both limbs paralyzed from anterior poliomyelitis. The fractured extremity was placed in Russell Traction. At the end of seven days traction a plaster spica cast was applied so that the child could be transported. The cast was removed after eight weeks and surprisingly good union was found with no shortening.

REFRACTURES OF FEMUR

Refracture of the femur occurred in 2 cases treated by Russell Traction and in one that was treated by traction and plaster. In the case of F. H., eleven years old, treated by Russell Traction, the mother was instructed to keep the child in bed for a further two weeks, because on *x*-ray examination there was found to be one inch of overriding. We overestimated the fixation of these fragments because of exuberant callus; hospitalization for two to four weeks longer might have prevented this refracture. The second case R. R., treated by Russell Traction was a child seven and a half years of age who had a spina bifida with paraplegia. She sustained a spiral fracture of the mid third of the femur and was treated in Russell Traction for six weeks. Two days after the removal of Russell Traction she sustained a supracondylar fracture of the same femur while lying in the bed. The third case N. L. seven years old was treated in Russell Traction for two days when it was discovered that the child had an active gonorrhoeal vaginitis. She was placed in plaster and traction which was removed after six weeks time. While in a bath tub she refractured her femur and a plaster traction apparatus was reapplied. The detailed reports of these 3 cases of refracture follows:

Case 1. F. H., eleven years old, was admitted on October 4, 1932 with a history that fifty-four hours previously he fell from a truck in Port Jervis, N. Y. and a wheel passed over the mid-portion of the left thigh. At Port Jervis thirty pounds of traction was applied

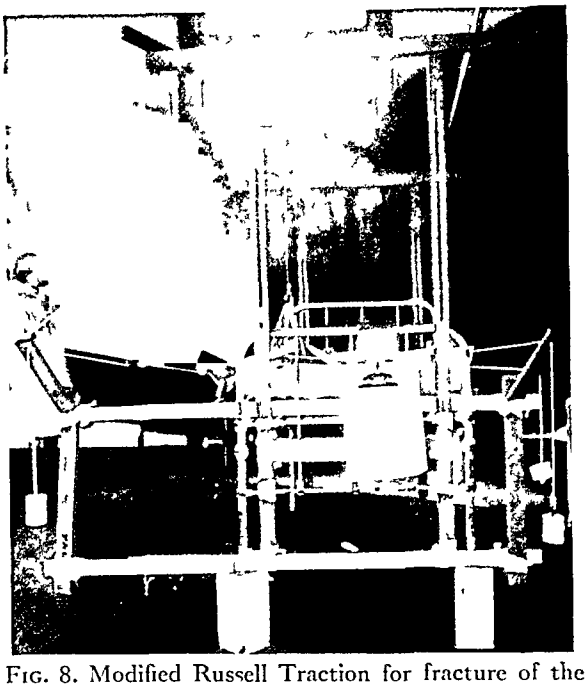


Fig. 8. Modified Russell Traction for fracture of the neck of the femur with both extremities in abduction and the fractured limb inverted.

and before removal to New York he was placed in spica plaster cast. At Bellevue Hospital radiographic examination revealed an oblique fracture of the midshaft of the femur with considerable overriding. The right leg measured 78.5 cm. and the left leg 77 cm. Russel Traction was applied with fifteen pounds weight for twenty-four hours and thereafter ten pounds was maintained. One week later the left leg measured 77 cm. and the right leg measured 78 cm. Subsequent *x*-ray films showed the lower fragment displaced posteriorly; three pounds weight was removed. On November 16, traction was discontinued. The callus appeared firm and there was no clinical deformity. The right leg measured 80.5 cm. and the left leg measured 79.5 cm. Twelve days later he was walking but with some difficulty. The patient was allowed to go home on December 7, and advised to remain in bed for two weeks longer. On December 22, 1932 the boy slipped and fell refracturing this femur. He returned to the hospital and Russell Traction was reapplied. His course thereafter was uneventful and traction was removed on January 31, 1933. At that time the right leg measured 80.5 cm. and

the left leg measured 80 cm. On February 26, 1933 he was allowed home with a walking caliper. The left thigh presented slight atrophy of the muscles but union was firm. One year later there was no residual changes in the muscles and the femur had assumed its normal contour without shortening.

Case II. R. R., seven and one-half years old, was admitted on June 15, 1933 with the history that while playing on the floor he rolled over and fractured his left femur. This child had been born with a lumbar myelomeningocele complicated with complete paraplegia below the waist, accounting for the fact that the child had no discomfort. There was slight swelling at the middle third of the right femur with a definite point of false motion. The right leg measured 64 and the left leg 63 cm. in length. Both legs were spastic. Radiographic examination revealed a spiral fracture in fairly good position involving the middle third of the right femur. Russell Traction was applied with six pounds of weight. The clinical course was uneventful and on August 7, 1933 traction was removed. Callus was extensive and union was firm. Two days later the child again fractured the left femur apparently by muscular contracture. On *x*-ray examination a transverse supracondylar fracture was found below the site of the previous fracture without displacement of the fragments. Russell Traction was reapplied for another six weeks. On October 4, 1933 the patient was discharged with good union of both fractures with only 1 cm. of shortening. Because of the difficulty in transporting the child she has failed to return to the clinic. Home visit by our social service reports no impediment resulting from the fracture; her disability being due to the paraplegia.

Case III. N. L., seven years old fell down a flight of stairs just before admission to Bellevue Hospital on November 28, 1930. While falling she twisted her right leg under her. A Russell Traction with twelve pounds weight was applied. Before suspension was applied the right leg measured 60.5 and the left leg measured 61 cm. in length. Radiographic examination revealed a fracture of the middle third of the right femur with forward displacement of the upper fragment with slight overriding of the fragments. On the second day Russell Traction was removed because the patient was suffering from gonorrheal vaginitis. She was placed in Burdick-Siris traction and was removed from the Children's Surgical Ward. On December 31, 1930 *x*-ray examination showed some backward displacement of upper fragment with overriding. On January 9, 1931 the cast was removed. The child was given a bath in a tub at which time the femur was refractured. The Burdick-Siris traction was reapplied. The course thereafter was uneventful. On March 8, 1931 the cast was removed. On March 19, 1931 the patient was discharged with moderate callus about the fracture with 45° flexion of knee. The right leg measured 63 and the left leg measured 62.5 cm. The follow-up on May 16, 1933 revealed both lower extremities measuring 71 cm. with no impairment of function and there was restoration of the contour of the femur to normal.

In reality only one case of refracture of the femur can be stated as having occurred after treatment with Russell Traction, namely, Case I. This refracture we attribute to an excessive amount of weight being used in traction which caused a wide separation of the fragments necessitating the formation of an abundant amount of callus, the strength of this being overestimated. It has been definitely established that too much weight will not correct overriding but will cause a spasm of the muscles and distortion of the lower fragments.[2]

RESULTS OF TREATMENT OF FRACTURES OF BOTH FEMURS BY RUSSELL TRACTION

Three children sustained fractures of both femurs and on admission were treated by Russell Traction applied to both extremities. No difficulty was encountered with this procedure and nursing care was made easier. The anatomical and functional results were excellent.

ANALYSIS OF CASES WITH FRACTURES OF BOTH FEMURS

Case IV. S. T., six years old, was admitted on September 9, 1933 with the history of being struck by an automobile and knocked unconscious. He complained of pain in both thighs and the left side of the head. The right thigh showed anterior bowing at the junction of the middle and lower third with crepitus

on attempted motion. The left thigh showed slight anterior bowing over the middle third of the femur. Radiographic examination revealed a spiral fracture of the middle third of the left femur with the fragments in good position and a fracture of the lower third of the right femur with backward displacement of the distal fragment with some overriding. Russell Traction was applied to each leg. At the time of admission the right leg measured 57 cm. and the left leg measured 58 cm. The traction was discontinued on September 13, 1933 at which time the formation of an exuberant amount of callus was shown to be present at the site of both fractures with firm union. On November 8, 1933 ninety days after admission he was discharged from the hospital. He had been up and around the ward for two weeks without impairment of motion. At this time the right leg measured 60 and the left leg 59.5 cm. On December 7, 1935 two years and four months after the injury, both femurs were of equal lengths, the shafts of the femurs had assumed their normal contours, and there was no impairment of function.

Case v. S. McG., nine years old, was admitted on March 18, 1932 two hours after jumping from a truck at which time a rear wheel had passed over both thighs. Radiographic examination showed a transverse fracture at the middle third of both femurs with outward and forward displacement of both upper fragments with overriding. The lower extremities measured 69 cm. Both limbs were placed in Russell Traction. On the forty-second day an exuberant amount of callus was present and therefore the traction was removed. For the first ten days out of traction both knees were moderately resistent to motion. On May 28, 1932 the patient was discharged with no shortening, firm union and no impairment of motion. He was followed until May 11, 1935, three years and two months after the accident. At that time both lower extremities measured 77 cm. There was no deformity, disability or impairment of function.

Case vi. E. S., six years old, was admitted on September 11, 1934 with the history of having been struck by an automobile and knocked unconscious. She complained of pain in both thighs and left arm. The left leg measured 54 and the right 59 cm. *X*-ray examination revealed a fracture of the left humerus and fractures through the middle of both femurs, with the comminuted and impacted ends of the right femur. The left femur was fractured transversely with 2 inches overriding. Both thighs were placed in Russell Traction. Some overriding of the fragments of the left femur persisted. On October 13, 1934 the callus was exuberant, union was firm and so the traction was discontinued. The right leg measured 60 cm. and the left leg measured 59 cm. On October 30, 1934 the patient was allowed in a wheel chair and on November 5, she began to walk. On November 8 she was taken to Willard Parker Hospital with scarlet fever. She returned at intervals to our clinic. Radiographic examination on December 7, 1935 revealed firm union, the right femur showed no traces of any previous fracture, the left femur was firmly united and the shaft was assuming its normal contour. Both extremities measured 61 cm. The function was perfect and there was no disability.

Results of Treatment of Fractures of Neck of Femur

During the past fifteen years there have been 10 cases of fracture of the neck of the femur admitted to the Children's Surgical Service. Six have been reported by Colonna.[3] Three of these were of the incomplete cervicotrochanteric type and in one case the fracture occurred through the narrowest portion of the neck. This study includes 4 cases, 2 of which were treated by the Whitman Method and 2 by the method of Russell Traction in abduction and internal rotation as illustrated in Figure 9. One of these patients had a subcapital fracture which was in fact an epiphyseal separation of the head and the other 3 were of the transcervical type.

Case Reports of Fractures of Neck of Femur

Case vii. A. P., seven years old, was admitted to Bellevue Hospital on July 3, 1933 soon after being run over by an automobile, with an extensive laceration of the perineum, vagina and right groin. She sustained a fracture of the neck of the left femur in the transcervical region and a comminuted fracture of the pelvis with separation of the sacroiliac joint. She was transfused and a plaster spica cast with a large

window for access to the wounds was applied. The wounds became infected and a low grade osteomyelitis developed, which subsided in three months. The patient was discharged from the hospital on March 20, 1934 at which time the anterior superior spine on the left side was tilted upward about 4 cm. higher than the right and there was 2 cm. shortening of the left lower extremity. Radiographic examination revealed marked rarifaction of the head and neck of the left femur. She was last seen in the clinic on December 7, 1935, two and a half years after her injury. She walked spryly with a raised wooden heel. The right hip was everted 30° and abducted 20°. The left lower extremity measured 59.5 and the right 61 cm. The head and neck of the femur were shrunken and partially absorbed and firmly ankylosed to the acetabulum. There was 2.5 cm. shortening.

Case VIII. M. W., was eight years old when she was struck by an automobile on September 23, 1933 about an hour before admission to the hospital. Examination revealed a fracture of the upper third of the left humerus, a fracture of the left clavicle and a transcervical fracture of the neck of the right femur. There was 40 per cent displacement of the head of the femur in an inward and downward direction. The fracture of the femur was not detected until two weeks after the injury at which time it was thought inadvisable to disturb the impaction. An anesthetic was administered and the right femur placed in position of abduction and inward rotation in a Whitman's cast with no attempt to correct the position of the fragments. On removal of the plaster cast two months later there was 2 cm. shortening. She was allowed out of bed two weeks later and discharged January 8,1934 with 45° flexion of the knee and 2 cm. shortening of the right leg. She returned to the clinic at intervals and was last seen on December 7, 1935 at which time there was perfect function with no limping or shortening of the right lower extremity. This fracture with 40 per cent displacement was not reduced but the neck and shaft reunited firmly with 2 cm. shortening of the leg and widening of the neck with a coxa vara deformity. Two years and two months after injury there was no impairment of motion in any direction, no pain or limp or shortening.

Case IX. S. W., was eleven years old when she was admitted on October 18, 1931 with a history of pain and inability to use the right hip for two weeks. Fourteen days previously she had fallen, after which she was able to walk with difficulty. On admission there was no definite tenderness, pain or ecchymosis over the right hip. The thigh was semiflexed with external rotation of the leg. The left leg measured 85.6 and the right 83 cm. Radiographic examination revealed a subcapital fracture, truly a separation of the epiphysis with outward rotation of the shaft of the femur. Sixty per cent of the head was in proximity with the neck. Both lower extremities were placed in a Russell Traction in marked abduction with internal rotation of the right leg. On October 23, 1931 the *x*-ray examination revealed 90 per cent reduction. On January 8, 1932 the traction was discontinued. Radiographic examination showed the head and neck in good alinement with some internal rotation. The *x*-ray examination on March 3, 1932 revealed the acetabulum considerably enlarged and eroded. Epiphyseolysis of the right hip was evident. The epiphysis of the head of the femur was somewhat smaller than that on the left side. The neck of the femur showed several small areas of bone atrophy but firm bony union. She was discharged from the hospital on March 17, 1932 approximately five months since the injury with complete abduction and rotation of the hip. The right leg measured 84 and the left 85 cm. She began to walk one month later at which time there was 1 cm. shortening. Five months later there was some limp present but abduction, adduction and rotation was complete and there was only 0.5 cm. of shortening. She returned to the clinic at frequent intervals. On December 7, 1935, four years and two months after the fracture was sustained, both lower extremities measured 94 cm., there was no limitation of abduction, adduction, rotation or flexion of the hip joint. The radiographic examination at this time revealed some shortening and thickening of the neck of the right femur. The functional result obtained in this case by the treatment with Russell Traction was excellent, the reduction was satisfactory, the nursing care was simplified and a considerable range of activity of the musculature of the thigh was obtained.

Case X. F. D., seven years old, fell from a first story window on July 10, 1935 and sustained a transcervical fracture of the neck of the femur. The extremity was suspended in Russell Traction with abduction and internal rotation and four pounds traction. The traction

was discontinued on September 10 and he was allowed to go home on September 27, 1935 with no shortening. He was instructed to remain in bed for another month. On January 4, 1936 there was no shortening of the extremity or limitation in range of motion of the hip. Radiographic examination showed evidence of union and no shortening of the neck. This case has been followed too short a time to warrant any definite conclusion. However our experience in the previous cases and the present status of the neck of his femur justifies our expectation of an uninterrupted perfect functional recovery.

The course of events in the 3 simple fractures of the neck of the femur in this series is a little at variance with those observed in the usual case of an adult. The circulation of blood through the ligamentum teres and the endosteal vessels from the major fragment was not impaired sufficiently to produce necrosis, absorption of the head and neck or non-union. On the contrary, there resulted an increased density of the osseous structure of the neck with adequate fixation. On discharge from the hospital 2 cases of simple fractures presented shortening and widening of the neck of the femur and one developed a coxa vara deformity. At the time that the last examinations were made of these 3 patients, six, twenty-six and fifty-six months respectively after each of their injuries, there was no shortening, pain, limp or impairment of mobility of the hip-joint in any of these.

The Russell Method of traction with the limbs in abduction and internal rotation is recommended for treatment of fractures of the neck of the femur. In Figure 4 Case VIII, both legs are illustrated in abduction and internal rotation. The fragments become welded into position and complete physiological rest is obtained while traction in the direction of the bony axis of the femur is exerted. As union progresses active motion of the extremity is permitted and the nursing problem is simplified. The simplicity and effectiveness in realining the fragments and the excellent functional results that are obtained justifies the recommendation of this procedure in fractures of the neck of the femur.

SUMMARY

One hundred and nineteen children with fractures of the femur have been treated on the Children's Surgical Service of Bellevue Hospital from January 1, 1930 to December 31, 1935; 30 of these by the Modified Bryant's Overhead Suspension, 15 by reduction on a Hawley Table and the application of a continuous adhesive skin traction and a plaster spica cast and 72 by Russell's Method of traction and suspension.

The procedures which gave uniformly good results in the 268 cases of fractures of the femur reported by Burdick and Siris in 1923 have been followed in this series with the exception that Russell's method of suspension has been added and has been found so satisfactory that it has gradually supplanted the cast and traction methods.

In the case of infants and children under four years of age, the Modified Bryant's Overhead Pulley Suspension with sufficient weight to keep the buttocks uninterruptedly off the mattress, is recommended.

The Russell Method of traction has been routinely adopted on the service for children older than four years of age for the following reasons; it is simple in its application and management; it is effectual in alining the fragments and it entails few nursing problems. The method permits early active motion and results in an exuberant amount of callus and complete restoration of function.

The incidence of satisfactory apposition of the fragments was higher with Russell Traction than with other methods that we have used. This in part can be attributed to the obligatory application of the Thomas splint to the injured limb by the ambulance surgeon before transporting the patient to the hospital from the site of accident.

There was no residual shortening in 109 of the 115 cases of fractures of the shaft of the femur. Three children in this group of 119 cases could not be traced.

The others were followed from three months to six years.

There was only one case in this series of separation of the upper epiphysis and none of the lower. One case of separation of the lower epiphysis occurred in our previous group. The separation of the upper epiphysis was effectually reduced by Russell Traction with the limb in abduction and internal rotation.

Fractures of the neck of the femur in children can be effectively reduced and treated with comfort in Modified Russell Traction the limb being held in abduction and internal rotation.

In this series of fractures of the shaft and neck of the femur there was no case of non-union.

When the anatomical approximation of the fragments of bone was absent the normal continuity and contour of the shaft of the femur became re-established within two to three years.

Open operation was not indicated in any case of this series and is rarely justified in children unless some mechanical interposition prevents union after prolonged immobilization.

REFERENCES

1. Burdick, C. G. and Siris, I. E. Fractures of the femur in children, treatment and end results in 268 cases: *Ann. Surg.* (June) 1923.
2. Russell, H. R. Fracture of the femur; *Brit. Jour. Surg.*, 9: 491, 1923–24.
3. Colonna, P. C. Fracture of the neck of the femur in childhood. *Ann. Surg.* (Nov.) 1928.

REFERENCES OF DRS. HENLINE AND MOORE*

3. Brooks, B. Arteriography with sodium iodide. *Jour. Am. Med. Assn.*, 82: 1016 (March) 1924.
4. Caporale, L. and Foa, A. Radiology of arteries, veins and pathologic cavities with iopax, *Minerva med.*, 2: 390–397, 1931.
5. dos Santos, R. Lamas, A. C., and Caldas, J. P. Artériographe des members et de l'aorte abdominale. Paris, Masson et Cie, 1931.
6. dos Santos, R. and Caldas, J. Use of thorium derivatives in arteriography. *Med. Contemp.*, 49: 234–236, 1931.
7. dos Santos, R. Aortic roentgenography in diagnosis of renal and pararenal tumors. *Lisboa Med.*, 10: 750–767, 1933.
8. dos Santos, R. Nouvelles applications cliniques de l'aortographie a quelques problemes de chirurgie renale. *Bull. Soc. franc. d'urol.*, 48–56, 1934.
9. Gottlieb, R. The effect of colloidal thorium on the blood picture. *Canad. Med. Assn. Jour.*, 28: 496 (May) 1933.
10. Graham, R. S. Circulation in normal and pathologic kidney with roentgenographic visualization of arterial tree, including glomeruli. *Am. Jour. Path.*, 4: 17–32, 1928.
11. Harris, W. H. and Friedrichs, A. V. Microscopic changes produced in tissues of animals injected with thorium dioxide for spleno-hepatography. *Proc. Soc. Exper. Biol. and Med.*, 29: 1047 (June) 1932.
12. Heuser, C. Direct arteriography by means of catheterization of right auricle and introduction of contrast substances. *Rev. Asoc. med. argent.*, 46: 1119–1128, 1932.
13. Legueu, Fey, and Truchot. Artériographie rénale. *Bull. Soc. franc. d'urol.*, 204–208 (June 15) 1931.
14. Martland, H. S. The danger of increasing the normal radioactivity of the human body. *Internat. Press.* 2: 781–791, 1932.
15. Meleney and Miller, Arteriography. *Ann. Surg.*, 81: 976–993 (May) 1925.
16. Otell, L. S., Coe, F. O. and Hedley, O. F. Thorotrast arteriography and veinography. *M. Ann. District of Columbia*, 2: 153–156, 1933.
17. Paolucci, F. Histologic research on arterial wall after arteriography. *Rassegna internaz. di clin. e terap.*, 12: 520–530, 1931.
18. Priwes, M. G. Internal topography of arterial system of kidney and kidney pelvis in man and domestic animals; anatomicoroentgenologic study. *Ztscbr. f. urol. Cbir.*, 40: 1–24, 1934.
19. Racine, M. and Reboul, H. Roentgenography of aorta after injection of contrast substances. *Jour. méd. franc.*, 23: 116–121, 1934.
20. Saito, M. and Kamikawa, K. New modification for injection method of arteriography. *Am. Jour. Surg.*, 17: 16–19, 1932.
21. Spehl, G. A propos de quelques cas d'artériographie des membres. *Jour. de Cbir. et Ann. de la Soc. Belga de Cbir.*, 2: 66, 1933.
22. Thorotrast: Report of Council on Pharmacy and Chemistry. *Jour. Am. Med. Assn.*, 99: 2183 (Dec. 24) 1932.
23. Yater, W. M. and Otell, L. S. The differential diagnosis of diseases of the liver and spleen with the aid of roentgenography after the intravenous injection of thorium dioxide solution. Experience with eighty patients. *Ann. Int. Med.*, 7: 381 (Sept.) 1933.
24. Yater, W. M. and White, C. S. Roentgenographic demonstration of arteriovenous aneurysm by means of thorotrast. *Am. Jour. Med. Sc.*, 186: 493–495 (Oct.) 1933.

* *Continued from p. 229.*

ETIOLOGY OF CHOLELITHIASIS

EXPERIMENTS OF THE AUTHOR

H. A. PETERSEN, M.D., F.A.C.S.

Visiting Surgeon, St. Joseph's Infirmary, Memorial and Methodist Hospitals

HOUSTON, TEXAS

IT is indeed remarkable that a disease so well understood in all its clinical manifestation and rendered practically certain of diagnosis through the comparatively recent studies of Graham and Cole, should be so obscure as regards etiology.

It is not my purpose to discuss the clinical manifestations nor the diagnosis and treatment of gallstone disease. In cholelithiasis, as in nearly every disease to which man is subject, our knowledge of its shaded clinical variety and, to no small degree its treatment has far outrun our knowledge of causation. A review of the progress made thus far is offered, clarifying our notions of gallstone etiology with a brief report of some experiments.

Two schools of thought regarding gallstone formation have arisen, namely, those who hold to the infectious origin of the disease and those who believe the underlying process to be a colloidal chemical phenomenon.

Modern knowledge of cholelithiasis began with Von Helmbach during the middle of the last century. His observations appeared under the caption, Microgeologie, published in 1856, in which he called attention to the analogy between calculi as found in man, and pearl and shell formation as found in the mollusk. Pearl formation usually began with an organic scaffolding, perhaps the result of inflammation to which inorganic salts adhered, with the resultant petrification of the base structure.

Preceded in 1856 by Mickel Von Helmbach who merely suggested it, Galippe, as early as 1886, advanced the theory of a microbic origin, yet the major credit for the demonstration of the infectious nature of cholelithiasis rightly belongs to Gilbert. His observations made in 1890 were utilized later by Naunyn at the Wiesbaden Congress in 1891, when Naunyn elaborated Gilbert's conception that stones are formed by the precipitation of substances normally contained in the bile, especially cholesterin, bilirubin and lime, and that such precipitation depended primarily upon biliary infection.

The decade following the Wiesbaden Congress, 1890 to 1900, was marked by the appearance of many investigators bent upon the experimental production of gallstones. Notably among them were Gilbert and his collaborators Girode, Dominici, Claude and Fournier; Mignot, Shade, Aschoff, Bacmeister, Exner and, in this country, Cushing, Richardson and Hunner. The experimental attempts of these workers to produce calculi of infectious origin were fraught with many difficulties and for a long time remained unavailing. In 1893 Gilbert and his workers noted the presence of "petites concretions verdatres," small green concretions which had formed during a typhoidal cholecystitis in a rabbit. Following this observation methodical, painstaking efforts were made over a period of years to obtain more perfect, undoubted concretions. In January, 1897, these efforts were rewarded by the formation of a definite stone obtained from the gall bladder of a dog previously innoculated with Bacillus coli communis. Gilbert and Fournier, however, failed to make known the results of their experiments until after Mignot, in May, 1897, had presented to the Societe de Chirurgie three small experimental stones formed in the gall bladder of a guinea pig, the colon bacillus having been used as the infective agent in the gall bladder. Mignot, after these careful and successful experiments, concluded that the

chief factors in the production of biliary lithiasis are: (1) the presence in the gall bladder of an attenuated organism of any variety; (2) a relative inertia of the biliary reservoir causing partial stasis and preventing the expulsion of soft concretions of cholesterin.

Gilbert and Fournier, stimulated by Mignot's idea of attenuation, succeeded in the production of biliary calculi in a rabbit, resultant from an infection with Bacillus typhosus. Gilbert however sounded a warning against the unreserved interpretation of human lithiasis in the same terms, since he was able also to produce lithiasis by chemical irritation of the vesical wall in the absence of infection. These calculi were regarded as stones in the primary stage of their development and were not unlike those produced in this country at a later date by Richardson and Cushing, as a result of gall-bladder infection by the same organism, Bacillus typhosus. The agglutination of Bacillus typhosus in bile was at that time commonly known, and most observers believed that it was this special property of bile, which in vivo caused agglutination of the Bacillus typhosus organisms, causing the formation of a nidus, or framework upon which the superstructures of stones could be added. This was Richardson's hypothesis, and using this principle he innoculated a previously agglutinated culture of Bacillus typhosus directly into the gall bladder of a rabbit. Many experiments in which this procedure was followed were conducted, and success in producing calculi obtained in only one instance. The presence of such groups of bacteria (a nidus) alone seems insufficient, since Richardson found in 5 out of 6 fatal cases, large clumps of organisms present without any evidence of stone formation. Hunner proceeded with experiments based upon the same principle as Richardson and Cushing, with no greater measure of success.

The foregoing resume touches only the outstanding efforts made to produce gallstones through the introduction of infecting organisms into the gall bladder. The organisms used were either Bacillus coli communis or Bacillus typhosus.

Of those workers in the field who tenaciously held to the colloidal chemical view as to the etiology, Aschoff was perhaps the first and foremost. Aschoff, a contemporary of Naunyn, could not subscribe entirely to the theory of stasis and infection, since he observed repeatedly that cholesterin stone formation recurred even in sterile bile. Further, from histological studies he found no evidence of inflammation, past or present, in the gall bladders containing cholesterin stones; whereas in those gall bladders containing stones of the other variety, (stratified, radiating) evidence of inflammation was always present. These views of Aschoff, which were written in 1891, have stood the test of time. It is common knowledge and an observation made constantly in the operating room, that in gall bladders containing cholesterin, the so called mulberry stones, there is no gross or microscopic evidence of present or past inflammation. Further, Aschoff differed with Naunyn as to the source of the cholesterin frequently observed in the gall-bladder epithelium, a very fundamental point in the production of cholesterin stones. Naunyn believed that the cholesterin so observed was a product of the gall-bladder epithelium, since these cells contained it in greater amounts than the liver cells. Aschoff regarded its greater abundance in the gall-bladder epithelium as an expression of absorption, the latter phenomenon being encouraged by such agencies as stasis due to mechanical factors, for example, pregnancy. This idea was supported in a measure by the experimental observations of Harley and Barratt, and likewise those of Hansemann, who introduced cholesterin stones from man into dogs, and noted a gradual dissolution with absorption, rather than an increase through added increment from the gall-bladder epithelium.

The development of the colloidal chemical viewpoint of gallstone etiology has

presented an interesting attack upon a very difficult problem. There can be little doubt that infection plays a vital role, except in the cholesterin stone, yet infection alone probably does not explain the process in its entirety. The colloidal theory presupposes colloidal precipitates, such as fibrin and other proteins, serum albumin and globulin, which appear in the bile as a result of inflammatory processes. With these colloids, crystalloids are brought down, which result in the stratification so frequently seen, of which the bilirubin lime calculus is the end result.

Foremost among the workers in the colloidal chemical approach to the problem have been Aschoff, Shade, Bacmeister, Exner and Heyrowsky.

Bacmeister concluded from his investigations that if bile were kept under sterile conditions for long periods, cholesterin precipitation occurred but believed that some essential change in the bile must take place first. He noted also that if gall-bladder epithelium were added the process was hastened very materially. This he attributed to the combination of the positively charged protein, with the negatively charged cholesterin particles, which resulted in precipitation. The colloidal chemical conditions involved are still matters of controversy, yet his results are vitally important, since in his observations infection played no role.

Entering into the controversy, Shade assumes the phenomenon happens only when the solvent action of the bile in cholesterin is altered, as for example, if the cholate disappears in stasis. Exner and Heyrowsky have actually demonstrated that this occurs in the autolysis of stagnant bile. They also find less cholate than normal in bile from fistulas of gallstone patients. Thus we see that though infection has been removed from consideration through the conditions of their experiments, stasis with resultant changes in the bile, have entered. These changes produced through stasis, namely a reduction in the solvent action of the bile and a disappearance of cholate, offer problems the explanation and solution of which have not as yet been forthcoming.

Many have held that the formation of cholesterin stones has been the direct result of a cholesterolemia. In diseases such as diabetes, pregnancy, and occasionally arteriosclerosis, there is an increase in the cholesterin content of the blood and bile. It would seem almost incredible from a theoretical colloid chemical viewpoint, that unless such an increase be very great, no precipitation of cholesterin would occur. On the other hand, Chalatoff obtained precipitation experimentally in the gall bladders of rabbits by cholesterin feeding.

Rous, McMaster and Drury of the Rockefeller Institute, recently have taken up the problem attacking the question of cholelithiasis in an extremely careful manner. In their studies they have attempted to exclude the factors of stasis, infection and gall-bladder activity, to show that gall-stone formation could take place in the absence of these. Infection and activity of the gall bladder were definitely excluded by the conditions of their experiments; but it seems doubtful if under any given conditions requiring collection through 25 or 30 cm. of tubing, that statis could be excluded. This becomes more problematical since the diameter of the tubing is greater than that of the common or hepatic ducts, and where the stream bed is wider the current is more stagnant. However, these workers have carried the problem further than their predecessors, their results leading them to conclude that in the intubated dog there are present certain sedimentations, which they term nuclei. These are described microscopically, as highly refractile spheres composed of an organic scaffolding of elastic mucous, with calcium carbonate and calcium bilirubinate deposited within the nucleus. They believed these nuclei of deposition to be showered into the bile stream as a result of liver damage, and to demonstrate their point, produced liver injury with toluendiamin and chloroform anesthesia. These experiments proved that as a result of liver

damage such nuclei are showered into the biliary stream. In working with human bile, though rather limited, nuclei were found only in 4 patients who had stones and a chronic mild inflammation of the gall bladder. The presence of nuclei within gallstones has been rather generally observed since Charcot, Naunyn and Lichtwitz stressed their importance in the early 1890's. With Lichtwitz, one still raises the question as to whether the nuclei are the result of an inflammatory process. The studies of Rous, McMaster and Drury, "Stone Building from Nuclei" have been most comprehensive and gratifying, yet of even greater significance may be their studies, "On the Relation of the Reaction of the Bile to Experimental Cholelithiasis."

The interesting observation was made that, in a large proportion of instances, bile from the gall bladder was frankly acid to litmus; whereas liver bile, derived from the hepatic duct, was nearly always somewhat alkaline, and usually markedly so. Using a potentiometer they found that at 37°C. liver bile was regularly alkaline, *p*H. 7.07 to 8.55. During fasting, they found the bile was less alkaline. Gall-bladder specimens obtained a few hours after eating were either neutral to litmus, or alkaline; whereas those procured after a fasting period of forty-eight hours, were usually markedly acid to litmus.

These observations were at first presumed to be original with Rous and his co-workers, but a review of the literature reveals they were preceeded in 1915 by Okada, who made similar observations, and in 1921 by like determinations of Nielson and Meyer.

Okada, using the dog and electrometric methods, found that gall-bladder bile ranged from *p*H 5.43 to 6.97 in the fasting animal, whereas liver bile procured through a fistula was always alkaline with a range in *p*H of 7.54 to 8.15, fasting having no influence upon the biles obtained from hepatic duct.

Nielson and Meyer using colorimetric methods and rabbits corroborated the work of Okada. They showed further, that base forming diets definitely increase the average titrable alkalinity of the bile, whence they inferred that the alkalinity was due to the presence of carbonates.

The explanation of this change in the bile within the gall bladder is not understood. Conceivably, it may be the result of chemical changes occurring in a labile secretion as a result of its prolonged retention at body heat, or, on the other hand, of some influence exerted by the organ of retention. The latter seems the more likely, since liver bile, which is alkaline, when collected in a balloon, as done by Rous, and kept warm remains highly alkaline. Nielson and Meyer also observed that in gall bladders, so injured by infection to lose this function, the *p*H of the bile remains that of the secretion as derived from the liver.

If the bile in the gall bladder is normally acid, as these observers maintain, one must regard this as a protective mechanish against the formation of the ordinary calcium bilirubinate stone, the variety found most often in association with cholecystitis. However, if the gall bladder has been so injured by infection as to lose this function,* of changing an alkaline hepatic bile to an acid reaction, one may believe that gallstones might form, or rather that such a media might be conducive to gallstone formation. On the other hand, an acid media would be favorable for the production of the cholesterin stone, the so called mulberry stone, since colloids are precipitated in an acid media.

Previous to these reports, Dr. Robt. T. Miller and I, in sixteen experimental animals, anastomosed the lower end of ileum to the gall bladder, producing a severe cholecystitis and a perihepatitis of marked degree, not unlike the condition so commonly found in patients with a severe

* Note. Until further studies are made, it is doubtful whether this change should be considered as a function of the gall bladder. When the particular point in question is clarified, then one can say whether the change from an alkaline hepatic bile to an acid gall-bladder bile has been occasioned through gall-bladder function or through an inherent change in the bile itself.

cholecystitis. In half of these, the anastomosis was freed later so as to simulate more closely the cholecystitis as found in man. After a period of several months, these animals were sacrificed, and in no instance was there a stone. Several animals showed many small concretions (petites concretions vedatres as described by the earlier workers, or the pepper granules of the more recent experimenters) but not a single bonafide stone. Discouraged by our failures to produce gallstones by infecting the gall bladder, an effort was made to determine whether or not gallstones could be produced experimentally, by changes in the hydrogen ion concentration in the bile. These experiments were begun in the Hunterian Laboratory at Baltimore, using eight to twelve dogs.

Method. In order to obtain a constantly acid bile, several attempts which were made fixing the gall bladder to the anterior abdominal wall and injecting weak acid directly into the fixed gall bladder, were unsatisfactory. A graft from the acid bearing portion of the stomach was transferred directly into the gall bladder without leaving an opening between the stomach and the gall bladder, at the same time leaving intact its blood supply contiguous with the stomach. In the beginning, some difficulty was experienced in avoiding tension and its concomitant necrosis of flap, since the transfer of such a flap necessitated almost a 180° twist of its pedicled base. Tension was avoided by making the flap a little nearer to the pylorus, at the sametime partially mobilizing the gall bladder. In later experiments the latter procedure was found to be unnecessary.

In order to secure alkaline biles, it was thought that similar pedicled flaps might be taken from the duodenum. This was tried, but here the duodenal lumen was so constricted that sharp kinking and obstruction followed, if a sufficiently large graft was taken. Therefore about 8 cm. of duodenum was isolated, both ends invaginated, and an anastomosis, fundus of gall bladder to side of isolated loop, was performed. The continuity of the duodenum was then reestablished either by end to end, or side to side anastomosis, whichever method could be most readily done.

The following proctocols of one animal in each group, are given in detail, describing the method of experiment.

Experiment No. 8. Dog No. 8.

Morphia gr. ⅙ hypo. was given twenty-five minutes before operation, which was done under ether anesthesia, requiring one hour for a transplantation of a flap from the acid bearing portion of the stomach to the gall bladder.

The abdomen was opened through a high right rectus incision. The stomach and gall bladder were exposed; no abnormality was present that would render the operation difficult. A site for the graft was chosen from the lesser curvature of the pyloric antrum of the stomach, which had a good blood supply; that is, containing a transverse branch of the coronary artery. An elliptical incision was made through all the coats of the stomach to a point opposite the origin of the blood vessel from the coronary artery, this being left intact as a base for the pedicle flap. The mucosa was divided across the base of the pedicle down to the submucosa. The opening, thus made in the stomach, was closed with a continuous suture of silk, reinforced with interrupted Lembert sutures of silk.

A linear incision was then made in the gall bladder and the graft sutured in situ with continuous silk, reinforced at the base with Lembert sutures of silk. The abdomen was then closed.

Experiment No. 9. Dog No. 9.

Morphia gr. ⅙ hypodermically was given one-half hour preoperatively. Isolation of loop of duodenum, lateral anastomosis of duodenum to ileum to secure continuity, and lateral anastomosis of the gall bladder to isolated loop, was done under ether anesthesia, requiring eighty-three minutes for the procedure. A high right rectus incision about 8 cm. in length was carried through skin, subcutaneous tissue to the rectus sheath, which was divided and the muscle separated by blunt dissection. The peritoneum was picked up and incised. The duodenum was brought into view, and a portion of the proximal third below the ampulla was isolated, and both ends were then

invaginated. Reestablishment of continuity was accomplished by lateral anastomosis. The isolated loop was washed, and lateral anastomosis made with the gall bladder. Closure was effected in the usual manner.



FIG. 1. FIG. 2.

FIG. 1. Site from which graft is taken, and blood supply to graft.

FIG. 2. Duodenal isolated loop anastomosed to gall bladder.

After a period of three to six months these animals were sacrificed, and the following observations were made:

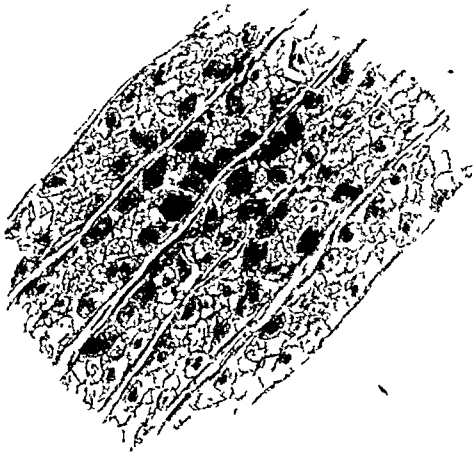


FIG. 3. Microscopic section of transplant.

The bile obtained from the gall bladder containing the duodenal transplants was alkaline to litmus. The bile in these animals was more viscid than normal, and in two instances was extremely dark and thick, resembling what is sometimes called when encountered in the human, "gall-bladder mud." There was no evidence of any stone formation.

The group which had the gastric transplant were far more interesting. The biles of these animals were definitely acid to litmus, and potentiometer readings by Dr. Emmett Holt on all except the recent experiments gave *p*H values varying between 6.4 to 6.8. None were as low as 5.4 recorded by Okada. The biles were thin and light colored and no stones were found; but the gall bladders resembled very strikingly the so-called "strawberry gall bladder," which I take them to represent. Grossly, the gall-bladder wall appeared reddened and congested with colesterin particles scattered over the entire surface. Some of this cholesterin could be washed off with gentle irrigation, indicating it to be free. A portion, however, could not be removed and was definitely either being

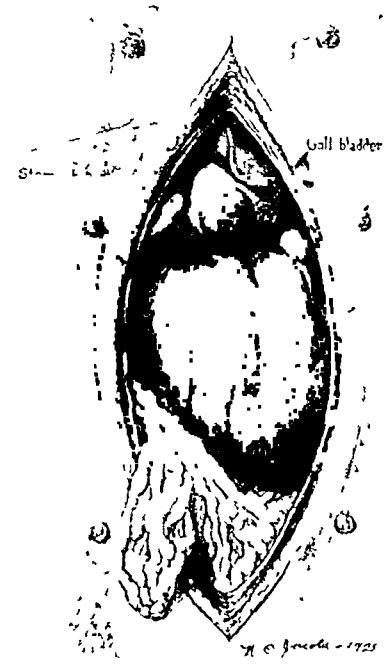


FIG. 4. Pedicle graft of stomach implanted into gall bladder.

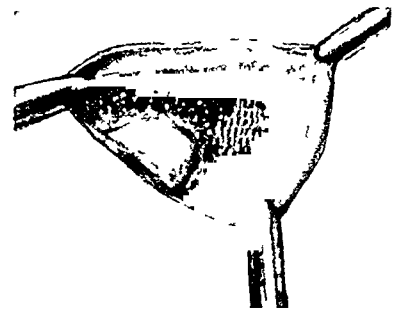


FIG. 5. A portion of gall-bladder wall showing gastric implant from within. Small cholesterin particles may be seen on surface of gall-bladder epithelium.

absorbed or secreted by the gall-bladder epithelium.

I am not able to determine whether this observation is one of secretion or absorption. However, I believe with Aschoff, as mentioned previously, the process to be one of absorption; that cholesterin has been precipitated in the presence of acid, and absorption is taking place. In several animals, where the knot of silk had been tied inside, the silk was working its way into the vesical and definite concretions of cholesterin were invariably around these. Sections taken from the gall bladder showed no evidence of infection, and those taken from the graft show the stomach mucosa to be perfectly normal.

There was no evidence of ulceration of the stomach mucosa transplanted into the gall bladder. This observation is beside the problem at hand, but is interesting in the light that it is sometimes stated, that the presence of bile in the pyloric antrum may be a factor in the production of gastric ulcer.

Detailed drawings show the method employed in the dogs bearing gastric implants in the gall bladder. This shows, with clarity, the site from which the graft was taken from the stomach and its implantation in the gall bladder. Figure 4, made at the time of autopsy three months after operation, shows how the graft has fared in its foreign environment with no apparent change.

Figure 5 shows perhaps better than description the appearance of the gall-bladder mucosa in these animals.

CONCLUSIONS

In these experiments, the actual production of gallstones cannot be regarded as having had any greater degree of success than that which gratified the number of workers who have previously attempted to produce them.

However, a condition has been produced in the experimental animal which may be regarded to be, what we clinically term a forerunner of gall stones, namely, the "strawberry gall bladder." Further it has been demonstrated that a gastric graft, when transplanted to the wall of the gall bladder, lives, and in so far as we are able to determine by electrometric determination of bile *p*H and microscopic appearance, continues to function.

REFERENCES

1. Mickel Von Helmbach. Mikrogeologie herausgegeben von Von Billroth, 1856.
2. Naunyn, B. Die Gallensteinkranken geiten. Congress in Weisbaden 1891. Klinik der Cholelithiasis in Leipzig. 1892. Cf. New Sydenham Society. 158, 1896.
3. Aschoff, L. Zur Frage der cholesterinbildung in der Gallenblase. *München. Med. Wchnschr.* 13: 1847, 1906. Mitt ans. d. Grenzgeberten 24: 1912.
4. Gilbert, A. Note pour servir a l'hestoire de la thecire, microbienne de la lithiase biliare. *Arch. gén. de méd.*, 11: 257, 1898.
5. Gilbert et Dominici: Angiocholite et cholecystite typhiques experimentales, *Compt. rendus Soc. de biol.* 23: 1033 (Dec.) 1893.
6. Mignot, R. L. origine microbienne des calculs biliaires. *Arch. gén. de Méd.* 11: 129–263, 1898. Rescherches experimentales et anatomques sur les cholecystitis Thesis, Par. 1896.
7. Gilbert et Fournier: Pathogenie de la lithias biliaris. Hestorique at etude critique etc. *Presse méd.* 14: 259–275 (Mai) 1898.
8. Bacmeister, A. Die Entstehung des Gallenstein Leidens Ergebn. d. inn. *Médecine*: 2:1–31, 1913. *Reise Ergebn. d. Chir.* 3: 1913.
9. Shade, H. Uber Konkrement bildungen bein Vorgang der tropfigen Entmischung Von Emulsions kolloiden. *München. Med. Wchnschr.* No. 1 and 2, 1909 and No. 14, 1911. *Ztschft. f. exp. Pathol. u. Therapie.* 8, 1910. *Kolloid. chemische Beihefte* 1: 375.
10. Exner, A. u. Heyrowsky, H. Zur Pathogenese der Cholelithiasis. *Arch. f. klin. Chir.* 86: 609–642, 1908. *Berl. klin. Wchnschr.* 1908.
11. Hofbauer, L. "Zur Pathogenese der Cholelithiasis." *Mitt. a.d. Grenzegebieten* 24, 1912.
12. Chalatoff. *Chir. Kongress blat.*, 4: 561, 1914.
13. Cushing, H. *Bull. Johns Hopkins Hosp.* 1: 166, 1899.
14. Lichtwitz, L. *Ergebn. inn. Med.* 13: 1, 1914.
15. Rous Peyton, McMaster, P. D. and Druru, Douglass R. Observations on some causes of gallstone formation. *Jour. Exper. Med.* xxxlx, 1: 77–96, 1924. *Jour. of Exper. Med.* xxxlx: 2: 97–116, 1924. Causes of gallstone formation, *Jour. of Exper. Med.* xxxlx: 3: 403–423, 1924.
16. Hunner, Guy L. *Bull. Johns Hopkins Hosp.* 10: 166, 1899.

CONTRIBUTING FACTORS OF PERITONEAL INFECTION IN CLOSED INCISIONS OF ABDOMEN

R. M. HARBIN, M.D., F.A.C.S.

Senior Surgeon, Harbin Hospital

ROME, GEORGIA

WHILE absolute asepsis is impossible a standardized aseptic technic seems to meet the needs of operative procedure in the great majority of cases. However, a certain number of cases with the same standard applied may be followed by unexpected infections and we are led to wonder what part in the process is played by the well nigh omnipresent so-called non-pathogenic bacteria. Spores of bacteria have been taken from the subzero temperature of the stratosphere and bacteria may be found in the buried ruins of Egypt. We know that various strains of certain bacteria show different degrees of virulence because of environmental influences and we have reason to believe that non-pathogenic bacteria under certain circumstances exhibit the same phenomena even becoming pathogenic, for the diphtheroids alone have been found at autopsy in endocarditis. In many pathological conditions these low grade bacteria seem to invite the presence of well known organisms. While scientific proof is lacking, clinical observation rationalizes such a theory which would explain hematogenous infections generally. Showing transmutation of types of organisms, Green of the University of Minnesota, has observed a retrograde evolution of bacteria into a parasitic growth in the cause of poliomyelitis.

Any active infections developing within the first three days of convalescence would indicate a break of the standard aseptic technic while unexpected low grade infections have slower beginnings usually unrecognized in which non-pathogenic bacteria play the initial part.

Robert et al.[1] have made some interesting research studies of the intraperitoneal low grade bacteria that harmonize with clinical observations. They showed 80 per cent of positive cultures, diphtheroids more commonly, from the normal peritoneum and smears from the surface of a diseased organ gave no greater degree of positive cultures than remote areas of the peritoneum. The same observation was made in diseased conditions. They also showed a similar degree of positive cultures from the knife, skin and air in the operating room. These studies indicated a constant flux of serum and it is probable that every case would show positive cultures at some time or other. In the more advanced conditions of inflammation these bacteria disappear with an increase of the Bacillus coli but in a later stage redevelop with all the evils of symbiosis. So there seems to be a low degree of infectivity in every abdominal section but under favorable circumstances it is usually whipped by the conservative processes of the peritoneum, for there is an increased effusion of serum after every abdominal section, primarily provoked by trauma, which acts as a challenge to infection. Any increase of virulence is attended by a corresponding degree of effusion and by means of diffusion brings about an attenuation which makes for resorption. Similar processes take place in pleurisy. Under normal conditions it would seem that the cycle of effusion and resorption is kept activated by low grade organisms and like other functions become accelerated in the presence of surgical trauma, shock and infection in general.

Therefore, it is easy to understand how such processes can be overtaxed in closed incisions where resorption is hindered by damaged peritoneal coats in the presence of tympany with a vitiated effusion. It is

also easy to understand how these conservative processes become handicapped in the resorption of infected effusions hindered by a closed incision that might otherwise be alleviated by a simple tissue tube drainage partly relieving intra-abdominal pressure. Low grade infections in peritoneal effusions that cannot be absorbed are a menace and theoretically considered, tissue tube drainage would be effective, while in the presence of exudative peritonitis the area drained would be restricted because of adhesions. This theory helps to explain the development of adhesions primarily through a process of incubation which finally becomes evident in seven to ten days and may cause either early ileus or late adhesions that ultimately provoke symptoms of chronic obstruction. It occasionally may be noted that adhesions become more extensive and serious following apparently normal convalescence than result from grave types of peritonitis. The remarkable absorbing processes of the peritoneum may be observed in the spontaneous disappearance of organized adhesions especially following subacute infections.

We have observed that these adhesions develop after leaving a quantity of normal saline solution in the peritoneal cavity, while the bovine amniotic fluid concentrate, amfetin, has seemed to have favorable results covering a period of six years, and it is our opinion that this serum shows more than coincidental value. The therapeutic value of amfetin has been advocated for promoting the biologically isotonic quality of peritoneal effusions for resorption, the normal means for eliminating the products of low grade infections. This biological quality seems to concern the fibrin content of effusions in serous cavities generally. Hence, stagnated effusions invite gross infections that may result secondarily in general sepsis or abscess formation.

The assumption is reasonable that the thickness of the peritoneum is an index to the degree of resistance and is more marked in the middle periods of life, as it is thinner in the extremes of ages and in obesity. The female seems more resistant than the male; perhaps having been inured to more or less extravasation and absorption of blood during the menstrual cycle[9] and other things being equal in the athletic type of the male the peritoneum is less resistant than in the frail type. Furthermore, in the pelvic peritoneum there is a greater degree of effusion and diffusion than in the upper abdomen which would explain certain well known clinical phenomena. Extraneous conditions of disease seem to have little effect on these local processes of the peritoneum. It should be remembered that the surface area of the peritoneum is greater than that of the skin.

Without reference to the controversial question of drainage it may be stated that a rubber tissue drainage tube should be applied to unload the peritoneum of a surplus of questionable serum not sufficiently attenuated for final absorption before plastic exudate occurs. The wisdom of drainage in border line cases may be verified by the amount of serum discharged and the absence of such would indicate that the peritoneum would have taken care of its own burdens. There seems to be more agreement in the manner of treating active infections requiring drainage and mortality statistics in such cases are quite uniform, but the difference of the total mortality rates pertains more to closed incisions in which surgeons depends on these conservative peritoneal processes and lose occasionally.

There has been some debate as to whether infections arise from within or from without, but Schumann[2] seems to have proved that those of a serious type proceed from within and infections of the abdominal wall concern chiefly a question of morbidity. However, those from within are more serious and occasionally fatal but may be preserved by a treatment that favors the conservative functions of the peritoneum. Meyer[3] says that retroperitoneal infections increase 100 per cent in virulence as com-

pared with those in the open and obviously because of a lack of attenuation and diffusion and that any infolding process such as the stump of the appendix changes an everpresent degree of infection to a retroperitoneal type. Our own clinical studies[4] seem to corroborate that conclusion.

We take clean surgery to mean that closed incisions are in evidence of the application of a standardized aseptic technic and since there are no means for asepticising low grade bacteria our main reliance rests upon dealing with the contributing factors of infection. Granting the theory that every abdominal section with a closed incision is followed by some type of peritonitis the manner of treatment becomes obvious. The mechanical phases of the surgical abdomen have not received sufficient study for a low grade virulence of infection in the presence of tympany may occasion a fatal ileus while more active infections of the peritoneum in the absence of intra-abdominal tension would have a favorable outcome. Adynamic ileus and intestinal paresis are confusing terms that relate to a terminal pathology inaugurated primarily by mechanical conditions and low grade infections and secondarily by disturbances of the sympathetic nervous system from surgical trauma, etc.

So any extensive operation that has an empty gastrointestinal tract so far as gas is concerned is less likely to encounter these hazards. Securing an empty stomach is not so simple as it may seem for we have siphoned as much as 1000 c.c. of gas from the stomach of a patient weighing 90 pounds with a scaphoid type of abdomen after a tedious operation, before leaving the operating room using a Levine tube into an inverted bottle of water. Retching from anesthesia seems to create an ebb and flow of gas from the stomach to the duodenum along with swallowing air. Tympany should always be regarded with apprehension and daily palpation of the epigastrium should never be omitted.

The tentative use of fluids by mouth in the first three days of convalescence has a doubtful value for the reason that very little usually reaches the colon and invites stagnation with its disagreeable sequela. According to Howe[5] starving does not hinder the healing of wounds. Intense thirst will not be relieved by the oral intake of fluids and is better relieved by morphine. Acidosis is a bugbear that makes for meddlesome treatment. Postoperative temperatures in clean cases may arise from various causes but low grade infection undoubtedly have a share in these causes.

There is hardly a discomfort in convalescence that cannot be relieved by morphine which according to competent opinions[6] does not promote intestinal atony. A tight bandage is never necessary except in the presence of excessive vomiting. Any preventive treatment by eliminating contributing causes, must receive routine application and such a regime should eliminate any ambition on the part of staff members to individualize postoperative treatment and thus demoralize any standards of a nursing system.

For example closed incisions for acute appendicitis may be taken for a comparative study as furnishing the greatest degree of potential infection and a review of such records at long range would seem to justify certain conclusions. In an interpretation of our own recent report[7] of 1084 closed incisions, or 68 per cent of the whole series, with one death for a period of twenty-five years, barring an element of chance we cannot discern any material difference of environment and technique from other clinics except the application of the principles of the subject matter of this discussion, however commonplace they may seem. On the other hand in eight other hospitals[8] with several scores of operators with different standards of postoperative treatment for a period of five years 3411, cases of closed incision or 82 per cent of the whole series, gave 129 deaths, the mortality rates of 8 to 10 per cent for drainage cases being about the same in either instance.

SUMMARY

1. Absolute asepsis being only a dream, the presence of low grade bacteria in the peritoneum cannot be ignored in a study of the causes of the initial development of adhesions and the so-called aseptic peritonitis.

2. Clinical observations seem to corroborate the theory that in closed incisions there is a causative relation between low grade bacteria and the more active type of infections in promoting virulence through synergy and symbiosis and that further research studies should rationalize the process.

3. The fate of low grade infections is determined within the incubation period of the first three or four days yet not in evidence until later, possibly leading secondarily to active infection, or else extensive adhesions.

4. Every abdominal section is followed by an increased effusion of serum with a wider diffusion and requires a certain degree of physiological attenuation for resorption.

5. Mechanically harmless tissue tubes will drain wider spaces before the stage of plastic exudates.

6. A proper postoperative regime more or less negative in character will safeguard to a great extent these remarkable conservative processes of the peritoneum unless already overtaxed.

7. The contributing factors of infection are surgical trauma, incomplete hemostasis, dead spaces, tension, tympany, trauma from peristalsis and vomiting, restlessness, infection from the stump of the appendix, etc.

8. In view of the necessity of long range viewpoints the ambition for individualizing the postoperative treatment of the average case of closed incision will not lead to any reliable conclusions as to the mitigation of infections in general and is a menace to an efficient nursing regime; for preventive measures require to be standardized and more or less routine in their application and when a greater number of deaths in any large number of cases occur in closed incisions for appendicitis than result from grossly infected types a serious reckoning should be undertaken.

9. The oft repeated statement that the fate of the patient is sealed when the incision is closed should be protested.

REFERENCES

1. Robert et al. *Surg. Gynec. and Obst.* 752, (Dec.) 1933.
2. Macfarlane. Infections of abdominal incisions. *Amer. Jour. Obst. and Gynec.* 6: 630–32, 1926.
3. Meyer. Retroperitoneal infections. *Ann. Surg.*, 249, (Feb.) 1934.
4. Harbin. The stump of the appendix as an agent of infection. *Ann. Surg.*, 633, (Apr.) 1934.
5. Howe et al. *Arch. Surg.* 27: 848, 1932.
6. Orr and Carlson. The effect of morphine on the intestine. *Arch. Surg.*, 27: 27–426 (Aug.) 1933.
7. Harbin. Appendicitis. *Jour. Am. Med. Assn.* 1321: (Apr. 21), 1934.
8. Boland. Appendicitis in eight Atlanta hospitals. *Jour. Am. Med. Assn.* 443, (Aug. 6) 1932.
9. Harbin. Unexpected postoperative infections. *Jour. Med. Assn. Georgia*, 132 (Apr.) 1932.

ANORECTAL FISTULA

ANATOMICAL CONSIDERATIONS AND TREATMENT

R. V. GORSCH, M.D.

Adjunct Professor of Proctology, New York Polyclinic Medical School and Hospital; Attending Surgeon, Proctology, Midtown Hospital; Assistant Attending Proctologist, New York Cancer Hospital

NEW YORK

THE operative treatment of anorectal fistula is one of the most ancient of surgical procedures having been recorded, according to Lockhart-Mummery, as early as 2200 B.C. Since that remote time much has been studied, discussed and written about it but the operative technique and the end results have changed but little since the classical description of the treatment of fistula by John Ardene in the fifteenth century.

Moreover, the pathological sequence in the formation of the common types of fistulas has been a controversial point, and there is still no complete or satisfactory or universally accepted explanation as to the exact pathways of the prefistula pathology, particularly the tuberculous variety.

It is not my object to describe the various operative procedures for the attempted cure of anorectal fistulas, which are available elsewhere; rather to call attention to the basic anatomical considerations, fundamental surgical principles and to describe an electrosurgical snare method which we have found useful in rectal fistulas with high internal openings. That surgery in this field is still unsatisfactory is well attested by a 20 to 50 per cent recurrence even in skilled hands.

It has been repeatedly observed that the anatomy of the anorectal region has been unduly neglected in medical training. Furthermore the modern surgical and proctological textbook fails to give a correct anatomical description of the anal musculature, particularly in their surgical relationship to fistula, fissure and hemorrhoids.

It is rather surprising that notwithstanding the vast amount of literature on fistula there is no complete agreement on the anal anatomy in the standard textbooks on proctology. Of course the descriptive anatomy has been handed down in biblical fashion which largely accounts for this fact.

All of this is not merely of academic interest for we are thoroughly convinced that much of the poor fistula surgery with its high percentage of recurrence and the varying degrees of resultant incontinence are in great part directly traceable to a lack of knowledge or misconception concerning the anal anatomy. Certain anatomical knowledge and considerations are absolutely essential to the practice of acceptable fistula surgery.

The cardinal fact in the surgery of fistula is the correct relationship of the internal opening or openings to the *anorectal line.* This has been emphasized and discussed in an excellent article by Milligen and Morgan, but has not yet received the attention which it merits from either the general surgeon or proctologist.

Other less important facts concerning fistulas, as the nature of the process, whether simple, tuberculous or otherwise, the postoperative care and complications have been discussed elsewhere and will not be considered here.

ANATOMICAL CONSIDERATIONS

There is still some confusion and disagreement regarding the anatomical arrangement of the external and internal anal spincters. Hiller, for example, in a detailed dissection of the anus concluded

that the external spincter was divided into superficial and deep layers and that the arrangement of the fibres was as

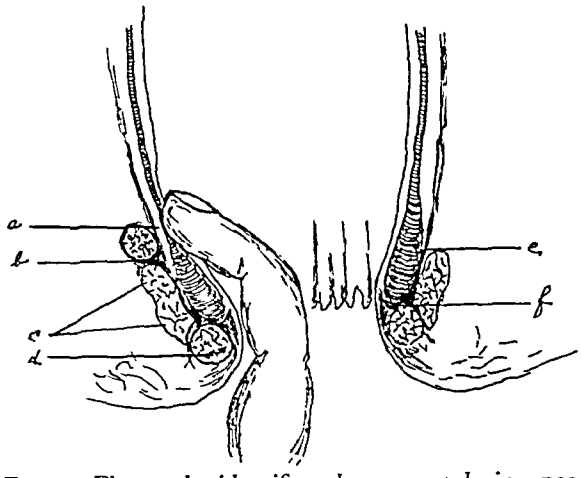


Fig. 1. Finger tip identifies the anorectal ring posteriorly. *a*. Anorectal ring posteriorly. *b*. Junction of profundus fibres of the external spincter with the puborectal fibres of the levator ani. *c*. Profundus and superficial portions of the external spincter ani. *d*. The subcutaneous portion of the external spincter ani. *e*. The anorectal ring anteriorly. *f*. The anal niche between the internal spincter ani and the subcutaneous external spincter ani.

follows "The external spincter consists neither entirely of fibres encircling the anus nor of fibres extending anteroposteriorly, but is a mixture of the latter type with fibres encircling the anus either anteriorly or posteriorly in varying proportions." He makes no precise distinction as to whether this arrangement applies in greater or less degree to the superficial or deeper portions of the muscle.

Milligen and Morgan, on the other hand, following along the descriptions of Holl, describe the external spincter as consisting of three layers, a subcutaneous, a superficial and a profundus.

The subcutaneous portion of the external spincter muscle nearly always surrounds the entire anal canal and its fibres do not extend, either crossed or uncrossed, posteriorly to be inserted into the sides or tip of the coccyx or anococcygeal body as is frequently but erroneously described and drawn in many textbooks. Anteriorly a few fibres may decussate.

The superficial layer is the one commonly referred to as the deep portion of the external muscle. It arises fairly constantly from the sides of the coccyx and anococcygeal raphe, splitting to surround the

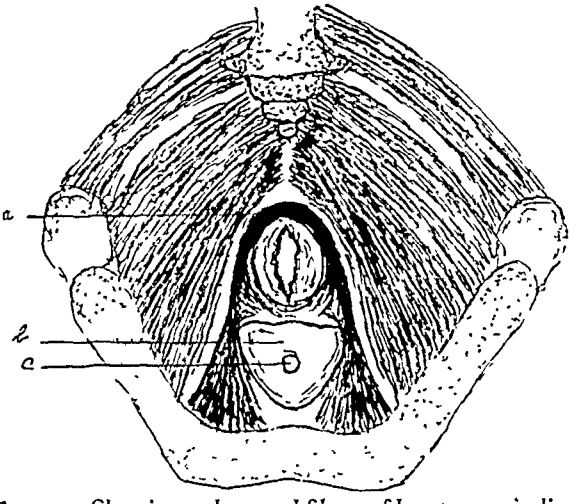


Fig. 2. *a*. Showing puborectal fibres of levator encircling the upper part of anal canal posteriorly. *b*. Prostate. *c*. Urethra.

midportion of the anal canal covering the circular and longitudinal muscles of the bowel, and continues to the central perineal tendinous point from which it may send ramifications to the skin.

The profundus layer is the deepest portion of the external spincter and similarly to the subcutaneous portion its fibres have an annular arrangement, entirely encircling the upper portion of the anal canal. Posteriorly it is in close apposition with the puborectal fibres of the levator ani and in conjunction with this muscle it forms the well defined upper margin of the anorectal ring. Anteriorly there are no puborectal fibres, because the levator has diverged laterally to its insertion in the lower pubes to surround the vagina in the female and the prostate in the male. The profundus fibres only, of the external muscle therefore forms the anorectal ring in the anterior half of the anal canal. (Figs. 1 and 2.)

These authors describe longitudinal muscle of the bowel as dividing into two or three fibromuscular septa which separate and insheathe the layers of the external muscle, particularly the subcutaneous portion. The continuation of the septum

downward has important connections of surgical significance. It passes between the lower border of the internal muscle and the upper border of the subcutaneous portion of the external spincter muscle, forming the anal intermuscular septum which is attached to the mucocutaneous junction of the anal canal at about Hilton's line.

These septal prolongations, furthermore, have some bearing on the spread of infectious processes and the ultimate location of the internal openings of fistulas. In the common, non-tuberculous type of fistula the infection probably arises in the bottom of a crypt, as Tuttle described many years ago, or in an abrasion of the mucosa. It then works its way out, usually above or through the subcutaneous external spincter muscle, following the fascial prolongations over the blood vessels as they pierce the anal fascia near the posterior midline, at 5 and 7 o'clock, the usual sites of posterior fistula openings. In this manner many infections reach the perianal and ischiorectal tissue. Hiller believes that the fascial covering of the blood vessels are important pathways for the dissemination of infections and clinical experience would seem to support this. The arrangement of the vessels, however, does not explain so readily the openings of high anal or rectal fistulas above the anorectal line or ring.

From the surgical standpoint of fistula, in particular, there are two important landmarks which deserve repetition and which in the operative technique should always be palpably recognized. These are, (1) the division between the subcutaneous external spincter muscle and the lower border of the internal spincter muscle, which also marks the insertion of the intermuscular septum; (2) the anorectal ring in its entire extent.

The classification of anorectal fistulas must be based on these simple recognizable landmarks and the ancient classification of complete, incomplete, blind internal and blind external, etc., which has been handed down with more rote than reason in the modern surgical and proctological texts, could be well discarded.

As already noted the cardinal fact of fistula surgery is the location of the internal opening in its relationship to the anal musculature and the anorectal ring, whatever the nature of the fistula. If this is not correctly established surgery usually fails and recurrence follows. The external openings are of minor importance from the surgical standpoint. Fistulas therefor may be classified as follows, modified somewhat from Milligan and Morgan.

CLASSIFICATION OF ANORECTAL FISTULAS

I. Anal Fistula
 - A. Extraspincteric
 1. Subcutaneous
 2. Submucous
 3. Intermuscular
 - B. Transsphincteric
 1. Low—opening just above or through the subcutaneous external spincter muscle; the common type.
 2. High—opening through the deeper portions of the external spincter, usually posteriorly but always below the anorectal ring.

II. Rectal Fistula
 1. Anterior
 2. Posterior
 3. Lateral

 Opening always above the anorectal ring.

This classification fails to differentiate fistulas opening into the bowel from those in which no internal opening is demonstrable, the so-called incomplete or blind variety.

But this, however, only serves to emphasize an important surgical aspect of the fistula problem in that, we question very strongly, whether the great majority of fistulas with no demonstrable internal opening should be treated surgically with

complete incision of the musculature. Graded external procedures, leaving the musculature intact, may in certain cases be justifiable.

In the patholysis of fistula it must be recognized that the original infectious track or tracks through the bowel wall may alternately heal over and break down. Therefor, the repeated injections with the proper technique and careful digital examinations of the tract is advisable to determine definitely the exact site of the internal opening before surgical intervention. This applies with particular emphasis to the frequently unsuspected tuberculous fistula.

The practice of opening and curetting tracts to the anal or rectal musculature with packing of the cavity in cases where no internal opening is demonstrable is a questionable practice. The anticipated hope that the internal opening "will take care of itself" is only too often realized, but by a recurrence.

The blind puncture of the mucosa, purposely or otherwise, in the belief that the true internal opening must be at that site, gambling on a satisfactory result, is also an unsurgical practice and should be discontinued.

Fistulas with two internal openings are usually overlooked. When found the higher opening should be dealt with first. If bilateral one side should be handled at a time, the higher opening first.

TREATMENT

The treatment of fistulas with low openings has been fully described and discussed in the standard proctologic textbook. Those however with high openings, through the deep portions of the external sphincter or into the rectum proper are sometimes difficult problems and we desire here to emphasize a few details in the operative technique and to describe an electrosurgical snare method which we believe has definite advantages in dealing with these high lying fistulas.

It is advisable to study a stereoscopic *x*-ray film of every patient with a fistula, as it may have an important bearing on the type of fistula and the anesthesia. There are no definite laboratory means of positively excluding tuberculosis in a fistula; negative microscopy and guinea pig innoculations are not conclusive. It has been our observation for many years that fistulas in patients who have or have had any degree of pulmonary or mediastinal tuberculosis should be regarded with suspicion.

The treatment of the extra-spincteric and the trans-spincteric fistulas with low openings entail but little fear of incontinence and spincter control. However, in those with high lateral openings through the deeper portions of the external spincter muscle there are several factors, usually overlooked, which may have an important bearing on the degree of resultant continence, a relative matter extending from the control of gas to a solid stool. These factors are, (1) the development of the anal musculature and its contractility, a tight or loose anal canal, sodomy, repeated dilatations, etc.; (2) previous divisions of the musculature resulting in scarring which interferes with the mobility of the muscles, and (3) diseases of the spinal cord, syphilis, diabetes, anemias, scleroses, etc.

The detection of the internal opening which can neither be palpated or probed, particularly in rectal or high lying anal fistula is facilitated by the injection of colored solutions or paste. Methylene blue in 50 per cent peroxide is our choice. It should not be injected with pressure. Under direct inspection of the entire anal canal and lower rectum the entrance of the blue is readily observed. The modified electric lighted wire speculum, shown in Figure 3, has been used by the author with great satisfaction. The entire anal canal is visible at one time and no matter where the internal opening may be it is usually readily observed. This speculum is likewise useful in incising submucous, submuscular and intermuscular fistulas. It is partly

adjustable to the anesthetized anus, and should never be used without some form of anesthesia.

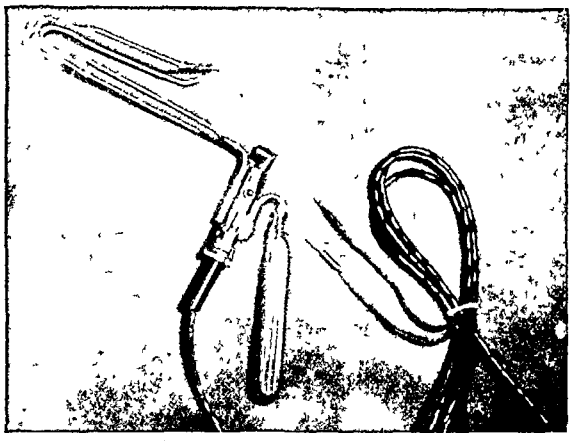


Fig. 3. Author's electric lighted wire speculum.

In scarred cases which have been operated several times this visual inspection affords the only means of accurately finding the internal opening before operation. Palpation alone in these cases may be misleading. There would be a decided improvement in the percentage of recurrence, now 30 to 50 per cent, if the internal opening were observed before surgical intervention. There is little hope of permanent cure unless the true pathological opening or openings are found and their anticipated exhibition during the surgical dissection is only too frequently disappointing and results in ill advised probing, curettings and packings.

In fact we seriously doubt the advisability or justification of surgery in fistulas, particularly the high anal and rectal types, where no internal opening is demonstrable and this applies particularly to those with lateral internal openings. Milligen and Morgan advise an extensive drainage procedure in these cases, without incision through the muscles; but one must admit the possibility of such fistulas resulting from infectious processes arising in the intramuscular glands of the rectal wall or those extending into the levator muscles. The importance of these glands in the etiology of fistula was observed by Hermann and Desfosses and more recently by Gordon-Watson and Dodd who report 3 definite cases of this type of fistula. Obviously the original pathways of infection from the rectum to the glands must be entirely eradicated to assure a favorable result and the extensive surgery, despite the adequate drainage and careful after-rare, is fraught with the danger of recurcence and incontinence. Certainly such cases should only be handled by experienced and skilled proctologists.

Where surgery is contraindicated or refused the injection of irradiated vaseline combined with carefully administered deep *x*-ray therapy may be of some palliative value.

In these high lying fistula we have used with complete satisfaction a method of setonizing the tract with wire and cutting it down by steps with the electric snare. The method was first described by the author in 1933 to the American Proctologic Society and has since been used by Yeomans, Frankfeldt and others.

It offers a rapid, safe and bloodless method of lowering the internal opening with little fear of incontinence in these particularly difficult fistulas. The technique is essentially as follows.

ELECTRIC SNARE SETON

Tonsil snare wire or preferably pure silver wire which is easier to manipulate, is drawn through the tract on a probe with a fenestrated tip. As a preliminary step the external portion of the tract with all its ramifications should be *excised*, shortening the main tract to within an inch or more of the anal musculature. It may be advisable to do this in stages if the excisions leave overhanging or too irregular skin edges which result in depressed and cavernous scars. The wire may be left in place until the external wounds have healed to the desired supportive points.

When the tract is to be cut down, the inner limb of the wire loop is insulated with a piece of bakelite or hard rubber tubing which protects the anal and rectal mucosa during coagulation. The wire ends

are then attached to the electric snare (Fig. 4). The loop now ensnares the muscles and is drawn taught as the current is applied. The wire cuts through the tissues depending on the amount and type of current and the rapidity with which the loop is pulled down. It is advisable to use a slow cutting current with considerable coagulation in its wake, so-called coagulotomy current, since bleeding may be free. The tissues are quickly separated and one must know his machine settings. Preliminary tests on raw meat are advisable. The method is not as simple as described but is effective and superior to other seton methods. The final wound through the entire anal musculature and into the perianal tissues should afford adequate drainage, which must be secured even at the expense of cutting the skin wound well out, a second time.

This method is likewise applicable and may prove successful in rectovaginal fistula in which the usual plastic operative procedures are refused. If it is not successful it can do no harm.

It may also prove of value in fistulas arising from bartholinitis with long perineovulval tracts, in which one stage operative procedures produce large gaping wounds with disabling scars.

SUMMARY

The anatomy of the anorectal musculature has been reviewed, particularly in its etiological relationship to fistula. A modified classification of anorectal fistula has been presented based on the location of the internal opening in its relation to the anorectal muscular ring. The surgical significance of this relationship in the successful treatment and more particularly in the preservation of anal continence, is emphasized.

An electrosurgical snare seton method is presented, which in the author's hands has proved a valuable and satisfactory technique in the treatment of difficult fistulas with high anal or true rectal openings.

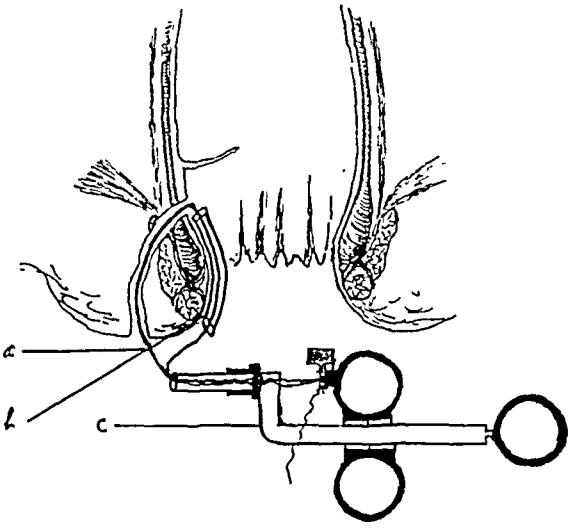


Fig. 4. *a*. Snare wire through fistulous tract. *b*. Curved bakelite tube to protect anal canal. *c*. Snare, bipolar technique.

REFERENCES

Ardene, John. Treatment of Fistula in Ano. Edited by D'Arcy Power, 1910.

Lockhart-Mummery, J. P. Proc. Roy. Soc. Med. 22: 33 (May 8) 1929.

Milligen, E. T. C. and Morgan, C. N. Surgical anatomy of the anal canal. *Lancet*, 2: 1150 and 1213, (Nov. 24, Dec. 1) 1934.

Gordon-Watson, C., and Dodd, H. Observations on fistula in ano in relation to the perianal intramuscular glands. *Brit. Jour. Surg.*, 22; 703 (Apr.) 1935.

Hiller, R. I. The anal sphincters and the pathogenesis of anal fissure and fistula. *Surg. Gynec. and Obst.*, 52: 921, (May) 1931.

Holl, M. Bardleben-Anatomie. 4th section, vol. VII, part II, sec. II—Maenlicher und weiblicher Damm. Jena: Gustav Fischer, 1897.

MODERN METHOD FOR PREVENTION OF POST-OPERATIVE DISTENTION*

A REPORT OF 88 CASES

WILLIAM R. LEVIS, M.D. AND E. L. AXELMAN, M.D.

PHILADELPHIA

POSTOPERATIVE intestinal atony is an all too familiar picture complicating convalescence. It is the purpose of this report to call attention to the results attendant upon our investigation of a new compound designed to abolish the appearance of this entity.

Theoretical discussion of postoperative intestinal atony is scarcely warranted here. This condition has been admirably discussed in a number of papers and so thoroughly classified both as to type and etiology that additional discussion would be burdensome and out of place.

Schumann and Missett define paralytic ileus as a motionless distention of the intestines due to paralysis of the muscular tunic of the bowel, and differentiate this type of ileus from dynamic ileus where hindrance of propulsion and expulsion of the intestinal contents is due to a definite mechanical obstruction somewhere along the course of the bowel. Our concept of postoperative intestinal atony is identical and we regard postoperative intestinal atony as a paralysis of the muscular tunic of the bowel attended by a moderate to extreme distention of part or all of the intestinal tract in the absence of any obstructive lesion.

Regardless of which cause is ascribed as being productive of postoperative intestinal atony, it is reasonable to state that this cause in most instances, is a direct or indirect sequel of surgical interference.

Many feel that the appearance of postoperative intestinal atony is, in a sense, an indictment of the surgeon, and while it cannot be denied that poor surgical technique and unnecessary handling of abdominal viscera increases the degree of intestinal atony, the appearance of this entity is not indicative of poor surgical technique. Practically every laparotomy has some degree of distention due to postoperative intestinal atony. The importance the condition assumes is in direct proportion to the degree of distention and the discomfort suffered by the patient. Despite the fact that many cases are so mild that they escape detection and spontaneously correct themselves with no therapeutic help, the fact remains that every laparotomy develops intestinal atony of varying degree. This is not surprising as mere opening of the abdominal cavity suffices to inaugurate intestinal atony of some degree.

The clinical picture of postoperative intestinal atony is well known, the ballooning belly attended by interference with circulation, toxemia, respiratory embarrassment and pain. Early therapeutic efforts were devoted to the correction of the established or developing condition. These efforts were concerned chiefly with the relief of pain and correction of the distention. Such treatment is therapeutically sound for correction of distention is soon followed by a remission of the concomitant symptoms. Attention to pain was forced by the insistent demands of the patient.

One of the earliest agents used in treating postoperative intestinal atony was morphine and strangely enough, continues to be used today. Such therapy amounts to ostrich like behavior, for we flatter ourselves that by abolishing pain through overwhelming the higher centers with opiates we have corrected the condition even though the physical status of the patient remained unchanged, as evidenced by the objective signs of distention. It

* Read before the Staff Meeting of the Crozer Hospital, December 23, 1935.

cannot be argued that this early therapy utilized the stimulating influence of morphine upon the muscular tunic of the intestinal walls. Moreover, analgesic doses of morphine sufficient to control the pain of postoperative distention may, and usually do, result in conversion of the generalized atony into spastic contractures alternating with areas of distention forced by pockets of imprisoned gas. An unpleasant picture and one completely masked by the analgesic effect of the opiate used.

The employment of extracts of the pituitary gland was a more rational therapy and a step forward in that the cause was being treated and not the effect. One objection to the use of pituitary gland products is that the action is not constant. Some maintain that the primary action of the glandular products is depression, succeeded by undesirable hypermotility and regardless of the dosage used a constant uniform action cannot be secured. Another objection to pituitary medication is the frequent occurrence of blanching reactions which have a terrifying effect on the patient and are not without actual danger.

Physostigmine or eserine has been employed in the treatment of postoperative intestinal atony. The effect on the bowel is good and the action is uniform and pronounced. Unfortunately, however, the stimulation of the entire parasympathetic system elicits a variety of effects, in addition to that upon the intestinal musculature particularly an effect upon the cardiovascular system. Moreover, eserine is distinctly toxic to the central nervous system, particularly the spinal portion. Due to its high toxicity and the variety of side effects elicited through its use, eserine has not been widely employed.

Duodenal suction siphonage by nasal catheter has afforded very satisfactory results, but this method is usually not employed until distention appears. Moreover, its efficacy is best exemplified in those conditions where there is obstruction, as dynamic ileus. Is it not possible in true adynamic paralytic ileus that such a measure will relieve only gas that is imprisoned rather high in the intestinal tract leaving untouched the lower portions? The same objection applies to the use of the rectal tube and enemas, which may serve to empty the lower portion of the intestinal tract but leave untouched the higher portion.

Of the older drugs which have been used postoperatively for distention, eserine salicylate administered parenterally has been attended, perhaps, by the most satisfactory results. The unpleasant by-effects which so often follow the administration of eserine led to various investigations of compounds possessing similar physiologic activity but lower toxicity. Stedman demonstrated that a substituted phenyl ester of a replaced carbamic acid or of carbamic acid itself possessing a basic group, will in general exhibit physiological activity similar to that of eserine. This work led Aeschlimann and Reinert, among others, to systematic investigations of urethanes of this type. Following exhaustive researches, Aeschlimann and Reinert found that of the substances synthesized and studied, the dimethyl-carbamic ester of 3-hydroxyphenyl-trimethyl ammonium methyl-sulphate exhibits pharmacologically the most promising effects. Subsequent clinical trials substantiated results obtained in animal experimentation.

This substance has been introduced into the materia medica under the trade name prostigmin. Chemically, it is a synthetic compound resembling eserine but differing from the natural alkaloid by its less complicated structure and its greater stability. Pharmacologically, in comparison with eserine, prostigmin is marked by a more pronounced action on smooth muscle tonus, a less pronounced miotic effect and the almost complete absence of cardiac by-effects.

Aeschlimann and Reinert, in their studies on the isolated frog heart found that eserine in a concentration of 1:1000 will often stop the heart in diastole, whereas in identical concentration, prostigmin causes at most a slight decrease

in amplitude. A one per cent solution of eserine almost invariably stops the heart in diastole, whereas solution of this concentration of prostigmin usually causes only a decrease in amplitude. On the isolated rabbit intestine prostigmin is still active in dilutions of 1:5,000,000; in some cases, a definite increase in tonicity was found even in dilutions of 1:7,500,000. On the intestine in situ, the effective intravenous dose is 0.02 mg. per kilogram.

Berk found that the isolated frog heart subjected to the action of strophanthin, will stop the heart in diastole following a five to seven minutes' treatment with a 1:2000 solution of eserine salicylate. Under similar conditions, prostigmin solutions of varying concentrations of 1:500 to 1:8000 is without influence on the action of strophanthin. The heart will stop in systole.

Rothschild compared the action of prostigmin with that of eserine on the normal isolated small intestine of the guinea pig. Prostigmin has a decidedly stronger peristaltic action than has eserine on the intestine rendered atonic either by atropine or epinephrine. Prostigmin restores tonicity to a greater than normal degree. Under influence of papaverine the tonus of the intestine slowly decreases. Treatment with prostigmin checks this decrease and gradually stimulates the intestine almost to the normal point. Eserine, under similar conditions, causes great variation of tonus but does not restore normal peristaltic conditions. The tonicity remains below its initial level.

Until recently the use of prostigmin in the field of surgery has been restricted almost solely to postoperative application as a treatment for distention and atony of the urinary bladder. For this purpose, 1 c.c. of a 1:2000 ampule solution is employed. A solution, having a concentration of 1:4000, is now available, prostigmin prophylactic, for use as a prophylactic against distention and bladder atony. A technique of administration has been developed, and it is recommended that the contents of an ampule, 1 c.c., be administered every six hours, starting a day before operation and continuing until the second or third postoperative day.

There are more than one hundred papers concerning the use of prostigmin in clinical application, and a number of the authors refer to the value of the drug as a prophylactic agent. In cases where adhesions existed, or were feared, Beck used routinely 0.5 c.c. of the 1:2000 prostigmin solution as a prophylactic and to maintain peristalic movements. Jeanneney, in a report on the effectiveness of prostigmin, calls particular attention to a case of mechanical ileus in which the drug was used both pre- and postoperatively. Mueller uses a prophylactic dose of prostigmin twelve to twenty-four hours after the treatment dose is administered.

It seemed important to perfect a technique for the prevention of postoperative intestinal atony. We define the preventive or prophylactic treatment of postoperative intestinal distention as the employment of small doses of the active agent administered at frequent intervals, beginning before the appearance of distention and continuing until the condition of the patient indicates that the danger has passed. Some feel that such prophylactic treatment may be instituted twenty-four hours before operation and continued two to three days following operation. We have preferred to start the prophylactic treatment shortly after or at the time of the operation and continue as necessary. This anticipatory type of treatment is justifiable in view of the fact that the incidence of postoperative intestinal atony through our technique has been reduced to a negligible minimum; prior to its use fully 60 to 75 per cent of our cases showed a varying degree of atony.

Our series numbered 88 cases, in which the application of prostigmin as a prophylactic against distention has been attended by satisfactory response. The routine in most of our cases, as we have stated, has been to start injections of prostigmin at the time of operation or shortly thereafter and continue injections for twenty-four

to forty-eight hours at four to six hour intervals, or until such time that we felt the condition of the patient indicated no further need of this medication. The last injection of prostigmin was followed by a soapsuds enema. The following are five representative reports of cases in which prostigmin has been applied prophylactically:

Case I. Mrs. L. W., age, fifty-two years, complained of epigastric distress four hours after eating, vomiting, and loss of weight for the past two years. Provisional diagnosis of gastric carcinoma was made. The laboratory findings showed the urine to be negative; the leucocyte count 8450, erythrocyte count 5,250,000, hemoglobin, 84.4 and color index, 0.8 per cent. Analysis of the gastric contents revealed occult blood to be absent, free HCl 59.2 per cent, total acidity, 76.7 per cent and combined acids and acid salts 16.43 per cent. *X*-ray inference was carcinoma of the pyloric end of the stomach. At operation a mass was found at the pyloric end of the stomach. A partial gastrectomy was done with anastomosis of the duodenum with the greater curvature of the stomach. Six hours post operatively prostigmin medication was started; second dose four hours later and the third given the following morning, eight hours after the second dose, followed by three additional injections at six hour intervals. Signs of distention disappeared, vomiting stopped and patient began gaining weight.

Case II. H. Z., age twenty-five years, diagnosed perforated gastric ulcer, complained of epigastric pain, nausea, vomiting and abdominal distention. The patient gave a history of indigestion over a long period of time followed by severe attacks of epigastric pain and in turn by abdominal distention. Operation revealed a perforated gastric ulcer which was repaired by excision of the ulcerated area. Prostigmin in this case was given every six hours for six doses starting four hours after operation. Morphine and atropine were given and possibly necessitated a subsequent dose of prostigmin. The patient made a complete uneventful recovery.

Case III. C. G., age thirty-eight years, diagnosed perforated gastric ulcer, complained of pain in right hypochondriac and epigastric regions, nausea and vomiting. There was a history of indigestion over a long period of time followed by sudden sharp pain. Operation revealed a ruptured gastric ulcer which was excised and the gastric wall repaired. Morphine and atropine were given in this case for relief of the pain. Prostigmin was given four hours after surgery and at four hour intervals for six doses and a seventh dose in two days because of slight signs of distention. This was given after a dose of morphine and atropine and we believe that the slight distention was due to the atropine. The recovery was uneventful.

Case IV. D. O., age fifty years, diagnosed, acute gangrenous cholelithiasis, complained of pain in right upper abdomen. There was a history of attacks of indigestion for a period of eight years in turn followed by severe pain in right upper abdomen and accompanied by severe chill. Operation revealed a perforated gangrenous gall bladder which was markedly hypertrophied. Prostigmin, 1 c.c., was given four hours after operation and continued for six doses at intervals of four hours. Recovery was uneventful, no distention being noted at any time.

Case V. Mrs. I. S., age forty-one years, diagnosed chronic endocervicitis, chronic appendicitis, chronic bilateral salpingitis, bilateral cystic ovaries, prolapsed uterus, complained of foul vaginal discharge, bearing down sensations and generalized abdominal pain. There was a history of foul leucorrhea for two years accompanied with fatigue. Operation consisted of bilateral salpingectomy, bilateral partial oophorectomy, dilatation and curettage, Gilliam suspension of uterus and appendectomy. Prostigmin, 1 c.c., was given five hours after surgery. Two doses given on the first day and four the next day, a soapsuds enema following the last injection of prostigmin. No abdominal distention was noted at any time. She made an uneventful recovery.

DISCUSSION

Review of the 88 cases forming the basis of this report show that prostigmin prophylactic has been most valuable in combating the much dreaded symptoms of postoperative distention and gas pains. In comparing these case records with an analogous series prior to our use of prostigmin prophylactic, we have found that distention and gas pains have been reduced to a negligible minimum. Prior to its use fully 60 to 75 per cent of our cases would show either

subjective symptoms of gas pain or objective signs of gastrointestinal atony or both.

Prior to the use of this product the glandular preparations were generally employed but our results were not sufficiently uniform to warrant continuation of their use.

After some experience with this product and with the thought in mind of finding the dosage technique which would give maximum results the following routine has been established. With inhalation anesthetics, the first injection of prostigmin prophylactic is given three to four hours after operation followed by a second injection four hours later; four injections are given at four hour intervals the first day after operation. The last dose of prostigmin prophylactic is followed immediately by a low soapsuds enema. This technique has proved very effective in preventing postoperative intestinal atony.

It will be noticed that the use of this product has been made routine since it is our opinion that it is good practice to prevent this dreaded condition rather than to wait until the patient complains of gas pains or distention is evident.

Most gratifying to the patient and nurse, as well as the surgeon, is the elimination of repeated high compound enemas, as milk and molasses, etc., rectal tubes, etc. for the relief of this painful and annoying condition.

It has been our experience that with this method of administering prostigmin prophylactic peristalsis has been established within twenty-four hours after operation, whereas prior to our use of prostigmin in abdominal cases peristalsis was not established until after a period of forty-eight and in some cases seventy-two hours.

Our use of prostigmin has not been attended by any untoward effects by way of systemic or local reaction, the blood pressure is not affected and cardiac action is not interrupted in any way.

SUMMARY AND CONCLUSIONS

Prostigmin prophylactic is a 1:4000 solution of the dimethylcarbamic ester of 3-hydroxyphenyl-trimethyl ammonium methylsulphate. It is available in ampules delivering 1 c.c. of the solution.

We have applied prostigmin prophylactic as a prophylactic against distention in 88 cases. A satisfactory response has followed medication in practically all of the cases.

Prostigmin prophylactic has proven the most effective preventive of postoperative intestinal atony that we have investigated thus far.

No by-effects, such as might be expected when effective doses of eserine are administered, have been observed.

REFERENCES

Clendening. Modern Methods of Treatment, 2d. Ed., St. Louis, 1928.

Schumann and Missett. Observations upon adynamic ileus. *Am. Jour. Obst. and Gynec.*, 26: 59, 1933.

Guthrie. Postoperative ileus. Its early recognition and control. *N.Y. State Jour. Med.*, 31: 1021, 1931.

Billings-Forcheimer's Therapeusis. George Blumer Ed., New York, 1926.

McCrae. Osler's Modern Medicine, 3rd Ed., Phila., 1926.

Bastedo. Materia Medica, Pharmacology and Therapeutics, 3rd Ed., Phila., 1933.

McGuigan. Text-book of Pharmacology and Therapeutics, Phila., 1928.

Sollmann. A Manual of Pharmacology, 4th Ed., Phila., 1932.

Wangensteen and Paine. Treatment of acute intestinal obstruction by suction with the duodenal tube. *Jour. Am. Med. Assn.*, 101: 1532, 1933.

Stedman. Fine chemicals, medicinal substances, and essential oils. Parasympathetic stimulants. *Reports of the Prog. of Applied Chem.*, 16: 621, 1931.

Aeschlimann and Reinert. The pharmacological action of some analogues of physostigmine. *Jour. Pharm. and Exper. Therap.*, 43: 413, 1931.

Berk. Ueber diastolische Strophanthinwirkung am isolierten Froschherzen nach Vorbehandlung mit parasympathischen Giften. *Arch. f. exper. Path. u. Pharmak.*, 168: 638, 1932.

Rothschild. Ueber ein neues Darmperistaltikum Prostigmin 'Roche'. *Med. Klin.*, 28: 365, 1932.

Beck. Zur Prophylaxe nach gynaekologischen Operationen mit Prostigmin. *Muench. Med. Wochenschr.*, 79: 389, 1932.

Jeanneney. Syndrome sympathicotonique postopératoire et ésérine. *Gazette Hebd. d. sc. méd. de Bordeaux*, 53: 796, 1932. L'épreuve de l'ésérine dans l'occlusion intestinale. *Gazette Hebd. d. sc. med. de Bordeaux*, 53: 796, 817, 1932. L'élément dynamique dans l'iléus macanique. L'épreuve de l'ésérine. *Gazette Med. de France*, 1932, No. 18, 721.

Mueller. Klinische Erfahrungen mit dem neuen Peristaltikum Prostigmin. *Zentralbl. f. Gynaekol.*, 59: 1596, 1932.

PROTEIN METABOLISM*

DISTURBANCES UNDER CONDITIONS OF SHOCK AND SURGICAL INTERFERENCE

A. LURJE, M.D.

Member of the Faculty, Surgical Clinic, and of the Central Laboratory for Scientific Research

MOSCOW, U. S. S. R.

UNDER ordinary conditions of life the protein metabolism is characterized by a certain constancy and is much less subject to changes caused by protein intake and pathological conditions than the more labile fat metabolism and the metabolism of carbohydrates. The concentration of "amino-N der Basen" in the blood, as an indicator of the content of the fundamental intermediate link in the protein metabolism, represents a more or less stable value showing transitory and insignificant changes after food intake and a considerable tenacity in the presence of pathological changes in the organs controlling protein metabolism.

Referring to the experiments on excision of the liver (Bollman, Mann, Magath), Van Slyke points out the fact that the removal of about 90 per cent of this organ, to which numerous physiological and clinical investigations ascribe the predominant role in the process of protein metabolism, was found to cause a rise in the amino-acid content of the blood. The work of Reiche,[2] Bufano[3] and others has shown that the increase in the amino-N in the blood under conditions of human pathology occurs chiefly either in cases of general disturbances of tissue metabolism or in those of severe liver damage (acute yellow atrophy, cirrhosis, etc.), these changes being sometimes demonstrated only by a more prolonged rise and a slow fall of the amino-N curve after test glycocol intake.

We decided to use the relative tenacity of the protein metabolism in pathological conditions, as compared to that of other forms of metabolism, for studying the degree of disturbance of the intermediate metabolism in conditions of serious operations leading sometimes to shock conditions, in cases of head injuries and in a number of experiments. With this purpose the amino-nitrogen in the blood of a group of seriously ill patients was studied repeatedly according to the Van Slyke gastrometric method on the micro-amino apparatus. Sixty-five patients were examined; 14 had been operated for the relief of cranial and cerebral disease; 6 had been admitted with head injuries; in 8 operations had been performed for pulmonary disease and in 13 for stomach disease.

During the operation in each case blood pressure and pulse rate were determined. Blood was withdrawn before operation at the time of the most marked disturbance of the general state, as indicated by a considerable fall in blood pressure reading, a failure in the general reaction under local anesthesia, profuse sweating, pallor and acceleration of the pulse rate. These symptoms in their various combinations and successions characterize the erectile and torpid phases of shock (Burdenko[5]) or conditions near shock.

In the group of patients in whom no disturbance of the general state was observed, blood was taken after a preliminary analysis at the end of the operation and later only when a second analysis showed some change. In analyzing our material attention was paid first to the factor of absence of a similar reaction (as concerned the quantitative increase of amino-N in the blood) in cases where the same organs were equally damaged, the same methods of anesthesia and of opera-

* From the Faculty Surgical Clinic, Chief, Honorary Prof. N. N. Bardenko, and The Central Laboratory for Scientific Research, Chief, Prof. S. J. Tchetshulin.

tion being used. This must be attributed to the individual ability of different organisms to regulate their protein metabolism and the amino-N equilibrium in the blood.

Our patients with cerebral diseases demonstrated that operations on the brain, being associated with a direct or reflex irritation of vegetative centers of the cerebral trunk, caused an increase of amino-acids in the blood from 8–10 mg. to 19–35 mg. per cent. If we consider the fact that our patients had a preoperative preparation of a twelve to fifteen hour fast and preliminary purgation, the natural assumption is that the increase of the amino-N volume in these cases was due to reflex endogenic breaking down of the proteins of the organism.

One woman with an intramedullary tumor of the third to sixth cervical vertebra and a tetraplegia, having a high amino-N level in the blood before operation, showed a fall of the amino-N volume from 22.4 to 17.4 mg. per cent, attended by weakening of the paralytic disturbances in the upper limbs after decompressive laminectomy with exposure of the spinal cord and its longitudinal dissection according to Elsberg. The last circumstance is attributed to the decompression of the remaining spinal cord. Freund and Grafe[6] found that in animals section of the spinal cord, even at a lower level (D5), produced by itself a 40 to 50 per cent increase in the amino-N in the blood. These authors associate this phenomenon with the absence of heat regulation. Thus the state of the patient in the period preceding operation can be compared approximately to the state of the experimental animals after the operations performed by Grafe and Freund, although the heat regulation of the patient during profuse sweating was maintained and the temperature sense as well as the sense of pain and tactile discrimination were also maintained on various areas of the body. The diminishing of the paralytic phenomena in the upper limbs after operation as one of the symptoms of decreased compression of the spinal cord, followed by a fall in the amino-N level in the blood, witnesses a decrease of irritation caused by the compression of vegetative paths and an improved regulation of the protein metabolism.

Among our patients with head injuries, 2 with fracture of the base of the skull without increase of intracranial pressure, as shown by lumbar punctue , and attended by an intracranial hemorrhage, exhibited a higher content of amino-N in the blood. In one of these cases, during a deterioration of the general state before death, a still higher content of the amino-N was observed. In the other case some improvement of the pulse rate and respiration, and return of consciousness, were followed by a fall of the amino-N levels in the blood.

One patient with a fracture of the os parietale, admitted with a high amino-N level in the blood, 21.2 mg. per cent, after the removal of pieces of bone pressing on the brain and a lumbar puncture showed a fall of the amino-N content of the blood to 11.2 mg. per cent. In 3 cases of commotio cerebri, 2 being most severe with suspected subarachnoid hemorrhage, an increased content of the amino-N was observed.

That change in the amino-N equilibrium is dependent upon reflex influences arising as a result of trauma under conditions of surgical intervention, is shown by our pulmonary operations. Thoracoplasty performed in cases of pulmonary abscesses and tuberculosis and consisting of resection of the lower ribs under paravertebral anesthesia was followed by a fall of the amino-N level in the blood although it usually led to severe damage to the general state with a considerable fall of the blood pressure, cold perspiration and weakened ability to react. The paravertebral anesthesia (D5–D12) abolished the conductivity of the respective portion of the splanchnic nerve. This fact was evidently due to reflex breaking down of endogenic proteins as a result of partial exclusion of the liver innervation, which in cases of

trauma reacts first by excretion of amino-acids. These findings agree perfectly with the results of researches by Hirschorn and Popper,[7] who obtained a fall of the amino-N curve after alimentary intake under paravertebral anesthesia.

Other pulmonary operations, as the insertion of extrapleural paraffin fillings, opening and drainage of abscesses, upper thoracoplasty performed under genera anesthesia as well as local, all produced a considerable increase of amino-N in the blood.

Stomach operations in cases of chronic disease also caused an increase of the amino-N in the blood, where the surgical intervention was carried out under local anesthesia combined with ether or under ether and avertin. The increase amounted from 8 to 12 to 17 to 25 mg. per cent. An exception was observed in 2 cases where splanchnic anesthesia was used, which apparently excluded the possibility of the reflex reaction of the liver in the form of excretion of amino-N into the blood. Five cases of perforated gastric ulcer observed and examined by us exhibited a somewhat different picture. Perforation of the ulcer is attended by an acute painful irritation having its greatest intensity during the first three to four hours after the perforation occurs. In our 3 cases the patients were admitted a few hours after the perforation and as a result of this intensive irritation we found high figures for the amino-N content, 17 to 19 mg. per cent, which decreased to 12 to 17 mg. per cent after the administration of morphine and anesthesia, even in spite of surgical intervention. The patients with perforated ulcer of the stomach who were admitted in a later stage of the disease showed a weakened endogenic breaking down and an improved regulation of protein metabolism. Here we observed the usual reaction: increase in the amino-N at those periods during operation associated with the most severe trauma and the possibility of a reflex irritation.

Ether and local anesthesia, which were used chiefly in the operations discussed, produced an insignificant toxic effect upon the amino-N equilibrium even when administered over a prolonged period. This was confirmed by a number of simple operations, as contracture of Dupuytren, chronic appendicitis, hernia, etc. In 6 cases with avertin anesthesia we observed a higher amino-N level in the blood than when other forms of anesthesia were used. The highest contents of amino-N were found in 2 cases of avertin asphyxiation (34 and 42.7 mg. per cent). Thus, in agreement with Vallebona Ubaldo, we are ready to attribute to the avertin a toxic influence on the liver and tissues, leading to an increase in the amino-N content of the blood.

In our experiments on animals we also tried to determine the influence of different forms of trauma on the regulation of the endogenic breaking down of proteins. For this purpose, in addition to clinical observation, we made analyses of the blood of cats and dogs subjected to diverse forms of trauma without the administration of any anesthetic. Head injuries attended by disappearance of the pain reaction, weakening of reflexes and loss of consciousness were found to cause a 40 to 50 per cent rise of the amino-N level of the blood. Experiments on traumatic shock provoked by inflicting crushing wounds of the limbs and creating strong painful irritations, although they did not always lead to a shock condition, nevertheless were usually attended by a gradual fall in the blood pressure after initial rises and showed a considerable increase of amino-N in the blood. We further attempted to create a strong irritation by inflation of the stomach by means of a metreurynter introduced through an esophagotomic orifice in the neck. The inflation was continued until the stomach ruptured, which was followed by a considerable pressure on the liver and damage of the respiratory excursions of the lungs as a result of pressure on the diaphragm. These experiments also led to a rise of the

amino-N level of the blood although its mechanism consisted not only in a reflex increase of the endogenic breakdown of proteins but apparently also in increased excretion of amino-N into the blood from the liver as a result of the immediate considerable compression of this organ.

To allow a clearer conception of the mechanism of the reflex increase of amino-N in the blood a number of experiments were made in cases of commotio cerebri with blocking of the nerves of the liver. The blocking was produced by injecting novocaine in the hepatoduodenal ligament and in the lesser omentum. In the last case we failed to observe any increase in the amino-N in the blood during the first hour after the trauma. Afterwards a slight increase of this component was found. This may be explained by the breakdown of the proteins in the tissues.

To conclude the review of our clinical and experimental data we would note that severe disturbances and fall of blood pres-

TABLE I

Case No	Age	Diagnosis	Operation	Anesthesia	Mgm. Per Cent Amino-N in Blood before Operation	Changes in General State Caused by Operation	Mgm. Per Cent Amino-N in Blood at End of Operation	Condition of Patient Post-operative	Mgm. Per Cent Amino-N in Blood
1	26	Left pulmonary abscess	Resection 7th and 8th ribs; removal of extrapleural filling; opening of abscess	Ether 80.0	10.5	Diminution of pressure from 116 to 110 mm.	19.4	Satisfactory 4 hours after operation	12
2	17	Right pulmonary abscess	Resection 5, 6, 7, 8 and 9th ribs; removal of filling; opening of abscess	Ether 90.0	7	Fall of blood pressure at end of operation up to 95; cold perspiration; shock condition	25	Shock condition in 20 min. in 40 min. 6 hours after operation patient improved	 24.5 25.2 14.4
3	33	Right pulmonary abscess	Resection 3, 4 and 5th ribs, between lower left axilla, anterior and posterior; introducing filling	Infiltration anesthesia novocaine 0.5 per cent	11.9	Fall of blood pressure at end of operation up to 95; cold perspiration; shock condition	22.1	30 min. after operation; shock condition 3 hours after operation, patient improved	 21.8 11.7
4	39	Right pulmonary abscess	Resection of 5 upper ribs under local anesthesia	Infiltration anesthesia novocaine 5 per cent	8.4	Some weakening of reaction; small diminution of pressure; sweating	28	5 hours after operation	10.8
5	28	Left pulmonary abscess	Resection of 8–13 cms. from 6–11th ribs	Infiltration plus paravertebral anesthesia	17.5	Fall of pulse rate; shock condition	16.2	1½ hours after operation, patient improved	12.7
6	35	Right pulmonary abscess	Resection 6, 7 and 8th ribs	Paravertebral anesthesia D-5 to D-9	17.4	Sharply marked fall of blood pressure and reaction; shock condition; cold sweat	12.2	2 hours after operation, patient improved	12.2
7	37	Right pulmonary abscess	Resection of 7–12 cms. from 6–11th ribs	Local plus paravertebral anesthesia	12.6	Sharply marked fall of blood pressure and of reaction; sweating; shock condition	11.9	4 hours after operation, patient improved	12.6
8	23	Right pulmonary abscess	Phrenic avulsion; resection of 8–12 cms. from 7 ribs on right side below	Local plus paravertebral anesthesia	12.2	Fall of pressure from 120 to 70 mm.; weakening of general reaction	12	5 hours after operation, patient improved	11.8

sure, weakening of the general reaction and cold sweating, the so-called shock condition, appear to develop in man and animals as a result of prolonged and severe traumas, which by themselves in the period preliminary to the shock lead to a considerable increase of the endogenic breaking down of proteins. The shock condition proper, especially in its torpid phase which is most suitable for study, appears to be connected with a severe alteration in the hemodynamics attended by an accumulation and retention of the blood in the liver (Burdenko, Smirnova[8]), exhaustion of the peripheral and central vegetative nervous system and damage of the conducting capacity. In consequence, the amino-N component of the blood remains quantitatively stable during the whole period of the shock condition of the patient. This is demonstrated by our observations in cases in which blood taken several times from patients in a shock condition has not shown any further change in the amino-N content. The surgical intervention by itself in these cases was not associated with a total or partial blocking of the nerves of the liver.

CONCLUSIONS

1. Severe surgical traumas in cases of intact innervation of the liver always lead to an increase of the amino-N content of the blood which appears to be the result of a reflex provoking endogenic breaking down of the proteins. Operations of the same degree of severity but associated with a partial or total exclusion of liver innervation by paravertebral or splanchnic anesthesia do not cause any increase in the amino-N content of the blood.

2. Severe head injuries and perforations of the stomach in early stages of disease show a high amino-N level of the blood.

3. Experiments on animals showed that diverse traumas cause an increase of the blood amino-nitrogen. Traumatic influences with blocking of the nerves of the liver do not cause any change in the amino-N content during the first hour.

4. A shock condition after prolonged hyperirritation associated with a rise in the amino-N level of the blood is characterized by a stabilization of the examined component; it appears to be the result of a severe disturbance of the hemodynamics with accumulation of the blood in the liver attending the shock, and lasts until the period of shock is over.

REFERENCES

1. Van Slyke. Quantitative Clinical Chemistry.
2. Reiche. *Med. Klin.*, pp. 599–605, 1933.
3. Bufano. *Clin. med. ital.*, 64: 803–818.
4. Vallebona Ubaldo. *Arch. soc. ital. di chir.*, 36: 682–703, 1930.
5. Burdenko. *Zentralny Med. J.*, pp. 393–406, 1934.
6. Freund and Grafe: In: Grafe-Oppenheimer's Handbuch der Biochem. Ed. 2, vol. 9.
7. Hirschorn and Popper. *Wien. klin. Wchnschr.*, 46: 1046–1049, 1933.
8. Burdenko and Smirnova. Report at the conference of the Moscow Medical Institute, 1935 and at the 23d Surgical Conference.

FROST-BITE

THEODORE KAPLAN, M.D.

Peripheral Vascular Clinic, Gouverneur Hospital, New York City, and St. Johns Riverside Hospital, Yonkers

NEW YORK CITY

FROST-bite is a local condition due to the action of cold upon tissues of the body as a result of which an area is deprived of its blood supply. Not only does exposure to extreme degrees of cold cause this condition within a short period of time, but exposures to moderate degrees of cold over a long period of time may have the same effect.

The process may occur in three forms, (1) mild, the stage of erythema, (2) moderate, the stage of vesiculation, and (3) terminal, the stage of gangrene. The occurrence of gangrene is seen more frequently in temperate climates than where extreme degrees of cold prevail, as in the Arctic Zone. One might explain this seemingly paradoxical absence of gangrene in regions where it would be expected to be rampant by the adaptability of the individual to the environment and the knowledge and use of prophylactic measures.

A reduction of temperature to or below freezing point of blood is not necessary to cause freezing of tissue, for it may occur even when blood temperature remains above zero, providing the following factors are present.[1]

1. *Moisture:* The transfer of cold air to the body is made more readily through a moist rather than through a dry medium, based on the laws of conduction. Chilling by cold air plus moisture, as through wet clothing, takes place through conduction. Chilling by cold air alone, takes place through the process of radiation, which gives the temperature of the parts affected more chance to adjust itself to its environment.

2. *Wind Velocity:* The loss of heat is greatest when air is in motion. Brahdy[2] has shown that the following ratio of the number of frost-bites to 10,000 men occurred when these conditions were present. At temperatures below 8°F. regardless of other conditions, the incidence of 5 or more cases could be expected; at temperatures between 8° and 14°F. the incidence of frost-bite was high only when there was strong wind movement; and at temperatures above 24°F. frost-bite rarely occurred, no matter how strong the winds.

3. *Predisposition Because of General Condition:* General body weakness and diseases or conditions which lower resistance, as diabetes, myocarditis, arteriosclerosis and postinfectious asthenia, minimize the protective defenses of the body and increase the susceptibility to frost-bite.

4. *Local Conditions:* Distal parts of the body when deprived of good circulation by virtue of vascular disturbances due either to organic occlusion or to constricting effects of improper clothing, as tight garters, tight shoes, are most sensitive to temperature changes.

5. *Previous Attacks:* Areas once frozen are subject to recurrences. Following exposure to cold complaints are made of sensations of burning or prickling.

The pathology resulting from the action of cold may be due to (1) a reduction of the temperature of the protoplasm, causing a change in colloid structure; (2) ischemia following spasticity of the arteries resulting in gangrene if prolonged; (3) reactionary hyperemia with transudation of serum, compressing the blood vessels and further cutting off the blood supply, and (4) rarely, thrombosis.[3,4,5] The exact cause for the pathological findings may be open to debate in that it may be ascribed to the direct action of cold on the protoplasm or to vasoconstriction. One factor

is conceded, that there is a change in the blood supply.

As mentioned, frost-bite appears in three stages of severity. The first stage is characterized by simple freezing with erythema. The part exposed becomes reddened and severe burning and prickling sensations result followed by vasoconstriction and anesthesia. This anesthesia is dangerous because continued exposure may further damage the part, unknown to the patient. If exposure is terminated early there follows an intense reddening associated with itching, prickly sensations and swelling. From this stage either recovery will follow or chilblains develop. The latter are characterized by bluish red, flat swellings or nodular elevations surrounded by a red zone.

The second stage is identified by the presence of vesicles or bulla on a reddened skin, containing clear fluid which upon breaking may heal or become the site of a stubborn, non-healing ulcer.

The third stage is reached when freezing is prolonged and interference with the circulation is complete. Gangrene is then the inevitable result.

The treatment of frost-bite is threefold; the prophylactic, the surgical and the physiotherapeutic.

Prophylactic: Dry, warm clothing is of the utmost importance. Ear muffs should be used; gloves to keep the hands warm are important; and socks should be well fitting and worn without elastic bands. It is regrettable that the ideal shoes for those exposed to cold have not yet been manufactured. If shoes are waterproof they retain perspiration; if they do permit ventilation they are not waterproof and absorb moisture, which is an excellent conductor. Therefore it can be seen readily that after exposure the feet should be examined and a complete change of footwear, both socks and shoes, be made immediately.

Greasing of the parts should be avoided, inasmuch as grease and oil act as conductors. Working at temperatures below 8°F. and between 8° and 14°F., with strong winds, should be postponed. There should be indoor rests of one-half hour after every two hours of outdoor work under these conditions. Smoking during and after exposure is inadvisable, inasmuch as tobacco causes vasoconstriction, retardation of the blood flow and a consequent drop in the temperature of the parts.[6]

Complaints of numbness and blanching are a danger signal and call for a discontinuance of work.

Those suffering from diabetes, arteriosclerosis, peripheral vascular diseases and general body weaknesses should not expose themselves to extreme degrees of low temperature, since their circulatory efficiency is not up to par and certainly cannot meet abnormal demands.

Surgical: In the treatment of the erythema stage, dry moderate warmth is desirable and is obtained by placing the affected part against the warm areas of the body. Application of too vigorous heat should be carefully avoided for it is conducive to hyperemia which results in the transudation of serum into the soft tissues and the compression of the blood vessels in an area already suffering from a lack of blood supply. Likewise, heat in the form of fomentations should not be used, for there may develop excessive reaction with exudation, blister formation, sloughing sepsis and subsequent moist gangrene.

The rubbing of snow on the affected parts is to be censured.[7] Snow in the city streets is gritty, moist and dirty and the friction may produce abrasions with subsequent infection. Dry, light massage, avoiding abrasions, is of value in restoring the circulation.

If recovery is delayed, the part should be kept warm, dry, elevated and immobilized. The most efficacious way is to wrap the part in dry cotton wool and bandage lightly. If spots of cyanosis, lividity and areas of anesthesia are present after a week, the affected part cannot be expected to recover.[8]

The vesicle stage of frost-bite is treated by opening the blebs under aseptic conditions and applying sterile dressings to the wounds. Stimulating ointments such as desitin, may be used to hasten the healing of the wound. Should the wound fail to heal under treatment by ointments, one may resort to the use of allantoin, whose effectiveness in the therapy of indolent ulcers has recently been reported.[9]

When the frost-bite has reached the stage of gangrene, conservatism and watchful waiting are extremely important. Before recourse to amputation is made, the line of demarcation should be seen. However, if infection intervenes or the gangrene spreads, surgical measures must be instituted promptly. Some have resorted to multiple incisions where the venous circulation is impaired.[10,11]

Physiotherapeutic: The use of diathermy followed by vigorous application of the Oudin current in conditions of chilblains has been effective.[12] For the treatment of the feet and toes, the footplate and cuff-above-the-ankle applications are used, and during the treatment luminous heat is applied for at least one-half hour. The current should produce a comfortable warmth and treatment should be given daily until there is improvement.

Successful treatment of frost-bite with short wave has also been reported.[13]

Good results with local ultraviolet irradiation from the air cooled lamp with the production of a second degree erythema have been reported. The treatments are repeated on the subsidence of the reaction.[14,15]

Galvanic baths at a strength of from 15 to 20 milliamperes have also been used.[16]

Recent reports on the use of the passive vascular exercise machine emphasize its efficacy in preventing the progress of frost bite to its terminal stage of gangrene.[17,18]

CONCLUSIONS

1. Frost-bite is prevalent in temperate climates and can occur at temperatures below 8°F. or between 8° and 14°F. in presence of strong winds.

2. The underlying pathology results in the disturbance of the blood supply to the part, either by destruction of the blood protoplasm or by interference with the circulation.

3. The symptoms may range from a mild erythema through a moderate degree of vesicle formation, to a severe degree terminating in gangrene.

4. Prophylaxis is an important factor in preventing this condition.

5. Conservatism should be displayed in instituting surgical measures.

6. Physiotherapeutic modalities are of proved value.

REFERENCES

1. Buerger, Leo. Circulatory Disease of Extremities, Phila., Saunders, 1924.
2. Brahdy, L. Frost bite among the employees of city of N. Y. during the winter of 1933–34, *Jour. Am. Med. Assn.*, 104: 529–32 (Feb. 16) 1935.
3. Von Winiwater. *Langenbeck's Arch.*, 23: 202, 1879.
4. Von Recklinghausen. *Deutsch. Chir.*, Lief 2 and 3.
5. Nagelsaach. *Munchen. med. Wchnschr.*, p. 353, 1919.
6. Maddock, W. G. and Coller, F. A. Peripheral vasoconstriction by tobacco, demonstrated by skin temperature changes, *Proc. Exper. Biol. and Med.*, 29: 487–488 (Jan.) 1932.
7. Macklin, A. H. Treatment of frost bite, *Lancet* I: 884–885, (April 25) 1925.
8. Mayer and Kohlschutter. *Deutsch. Ztschr. f. Chir.*, 127 (March), 1925.
9. Kaplan, Theodore. Allantoin treatment of ulcers, Accepted for publication, *Jour. Am. Med. Assn.*
10. Noesske. *Chir. Korg.*, Stuttgart, 1930.
11. Weitig. *Zentralbl. f. Chir.*, Nos. 16 and 52, 1913.
12. Kovacs, Richard. Electrotherapy and Light Therapy, 2nd Ed., 636–637.
13. Burckman. Treatment of frost bites with short waves, *Demat. Wchschr.*, 98: 622 (May) 1935.
14. Bach, H. Value of quartz lamp irradiation in treatment of freezing, *Strahlentherapie*, 32: 612, 1929.
15. Humphries, F. H. Artificial Sunlight and its Therapeutic value, 5th Edition, London Oxford Medical Publishing Co., 1929: pps. 182–184.
16. Kowarschik, J. Elektrotherapie, 3rd Ed., Berlin, J. Springer, 1929.
17. Herman, L. G. and Reid, M. R. The pavex (passive vascular exercise) treatment of obliterative arterial disease of the extremities, Jour. Med. (Dec.) 1933.
18. Shipley, A. M. and Yeager, G. H. Passive vascular exercise in treatment of peripheral circulatory diseases, *Surg., Gynec. and Obst.*, 59: 480–85 (Sept.) 1934.

AUTOHEMOTRANSFUSION IN PREVENTING POSTOPERATIVE LUNG COMPLICATIONS*

MICHAEL W. METTENLEITER, M.D., F.A.C.S.

Instructor in Surgery, New York Post-Graduate Hospital Medical School and Hospital

NEW YORK

THE administration of blood as a therapeutic agent is a very old procedure, and in primary anemic cases where the replacement of substance plays the main role, is, of course, well known. The application we have in mind is the withdrawal of a small amount of blood from the patient's vein and reinjection directly into the body.

In 1898, Grafstrom and Elfstrom[1] applied autotransfusion in a case of pneumonia. Ten years later Balfour[2] used this method as a specific therapy. All authors employed it purely empirically without explanation of its action. In 1913 autohemotherapy was advocated by Spiethoff[3] in dermatology and considered an unspecific protein therapy. Autohemotherapy has since been used extensively in a variety of diseases and conditions. The results were encouraging in postoperative pneumonia, furunculosis, bronchitis, eczemas and urticaria.

A good result in postoperative lung complications is manifested by the decline of temperature within twenty-four to forty-eight hours after administration and disappearance of symptoms.

There are five different methods of application:

1. Intramuscular injection of defibrinated blood; 20 c.c. of blood is defibrinated by shaking in a flask with glassbeads and injected immediately.

2. Intramuscular injection of 16 c.c. of fresh blood mixed with 4 c.c. of distilled water.

3. Intramuscular injection of unaltered fresh blood.

4. Intravenous injection of defibrinated fresh blood or blood kept on ice for several hours or even days.

5. Intradermal injection of small quantities 1 to 2 c.c., of fresh blood.

The intravenous injection occasionally produces tinnitus, palpitation or other shock symptoms, therefore intramuscular application is preferable. As much as 40 c.c. can be injected intramuscularly without technical difficulties or discomfort to the patient.

Although autohemotherapy was formerly used empirically, we now have a clear explanation for its action.

The rough constituents of blood serum and the subtle changes of the various proteins and derivatives have been brought to light in recent years. Benhold[4] claims that the various albumins, globulins, pseudoglobulins and euglobulins possess physiochemical properties permitting various graduations from one to the other but still retaining their separate specific functions. When blood is employed outside its natural place in the circulatory system it becomes quite a different substance for the body. Its physical chemistry is changed immediately after withdrawal from a blood vessel.

The stimulating effect of parenteral proteins on the sympathetic and parasympathetic system is demonstrated by the following simple test: when defibrinated blood is injected intravenously it immediately produces dilatation of the blood vessel and redness of the skin, peripheral from the point of injection. This redness changes later to a bluish discoloration.

* Based upon 300 private surgical operations.

The general effects upon the autonomic nervous system are even more striking. After the injection of defibrinated blood, vascular reactions combined with reactions of the respective tissues occur all over the body.

Widal and several others[5] observed a marked decrease in the number of leucocytes in the entire peripheral vascular system. Muller and Petersen[6] demonstrated later that this peripheral decrease corresponds to an increase of these cells in the abdominal organs. With this increase in the number of leucocytes in the abdominal organs there is a corresponding increase of the tissue functions, particularly the liver, accelerating the bile secretion and the detoxication procedures.[7]

It seems evident that these reactions depend upon sympathetic or parasympathetic stimulations initiated by the injection of defibrinated blood. This also occurs with other proteins. No effect upon the vasomotoric system, blood or tissues takes place after injection where the autonomic nerve supply of the respective organs is severed.

The reticulo-endothelial system is also definitely stimulated by autohemotherapy. Recent investigations give a well founded explanation for this effect. (Schurer.[8])

There is a simple method for testing the effect of stimulating subcutaneous tissues and cells of vascular walls. A cantharidenplaster, 1 sq. cm. in size, is applied on the thigh for twenty-four hours. A vesicle which formed is opened. The fluid is evacuated and brought into a "U" tube and centrifuged. The sediment is air dried, stained and a differential white blood count is done. (Kauffman.) The normal monocytes incidence is about 5 per cent. After an autohemotransfusion the monocytes in the differential count increase to 22 per cent in eight hours and 20 per cent are still present after seventy-two hours. The curve drops gradually within seven days and returns to normal after several weeks.

The reticulo-endothelial system is also able to store dyes. Colorimetric determination with Kongored (Schurer[8]) revealed a greater reserve after autohemotransfusion. Another test utilizes a bactericidal index after Wright's method. After injection the index shows an increase in a few hours and after eight hours reaches a maximum of 15 to 20 times normal. Like the increase in monocytes, the changes in the bactericidal index prove the stimulation of the defensive powers of the organism, resulting in higher body resistance.

Schurer's investigations suggest that the absorption of the injected blood starts rather quickly. We know that the absorption of milk, novoprotein and other protein substances can be demonstrated after four to six hours.[9] Blood is absorbed after one hour in sufficient quantity to produce the ferment called glycyltryptophanase in the blood stream.

Stimulation of the blood forming tissues in the bone marrow has also been definitely recognized after intramuscular injections of blood or other foreign proteins. Hoff[9] and several others could demonstrate this important symptom as a part of the therapeutic value of protein therapy.

These conclusions point to the wisdom of autohemotransfusion immediately after operation in an effort to prevent postoperative lung complications.

We have used autohemotransfusion in a series of 300 surgical cases, injecting 20 c.c. fresh blood intramuscularly immediately after operation. No lung complications, as postoperative bronchitis or pneumonia, were observed. Only one case developed a small thrombotic area in one lung five days after operation. The operations performed were gastroenterostomies, cholecystectomies, appendectomies, hysterectomies, ovariotomies, herniotomies, thyroidectomies, mastectomies, etc., under general anesthesia with gas and ether, avertin as base and local anesthesia. Postoperative complications may arise with any kind or method of anesthesia, but the absence of lung involvements in our series indicates that autohemotherapy

and not the type of anesthesia applied accounted for the good results.

There is sometimes a negligible amount of blood left in the wound, and it has been suggested that the absorption of this blood may render an additional autotransfusion unnecessary. The physiochemical changes in the whole blood and in the serum are so delicate and occur so rapidly that no comparison can be made between blood drawn from a vein and reinjected intramuscularly and blood left in a wound to be absorbed. These two processes are entirely different.

CONCLUSION

1. The intramuscular administration of 20 c.c. of autogenous blood after operation has a stimulating effect upon the reticuloendothelial system and the sympathetic nervous system which in turn increases activity and resistance of tissues.

2. The method is without danger. This procedure has been used in 300 cases with good results in the prevention of postoperative lung complications and possibly less frequent occurrence of postoperative embolism.

REFERENCES

1. Elfstrom, C. and Grafstrom, A. A preliminary report of experiments with heated blood in the treatment of croupous pneumonia. *N. Y. Med. Jour.*, 68: 307, 1898.
2. Balfour. *Brit. med. Jour.*, 1909. Cit. Hoffheinz, S.: Eigenbluttherapie in der Chirurgie. *Ergebn. d. Chir. u. Orth.*, 22: 152, 1929.
3. Spiethoff, B. Zur therapeutischen Verwendung des Eigenserums. *Münch. med. Wchnschr.*, 521: 1913.
4. Cit. Kylen. Ist es berechtigt, das Bluteiweiss als ein spezifisches Organ aufzufassen? *Med. Klinik*, 6: 171, 1935.
5. Widal, F. L'anaphylaxie. *Presse med.*, 79: 781, 1921.
6. Mueller, E. F. and Wiener, P. The mechanism of insulin action. *Arch. of Int. Med.*, 37: 4, 512, 1926.
7. Mueller, E. F. and Brutt, H. Die zentrale Bedeutung der Leber bei der natuerlichen Abwehr von Infektionen. *Münch. med. Wchnschr.*, 2044: 1929.
8. Schurer-Waldheim, F. Ueber die Wirkungsweise der Eigenblutbehandlung. *Deutsch. Ztschr. f. Chir.*, 239: 352: 1933.
9. Hoff, F. Klinische Beitraege zur Frage der zentralnervoesen Regulation des Blutes. *Klin. Wchnschr.*, 42, 1751, 1932.

APPLICATION OF ADHESIVE PLASTER

GUSTAV ZECHEL, M.D., F.A.C.S.

Assistant Professor of Anatomy and Associate in Surgery, College of Medicine, University of Illinois, Chicago, Illinois

CHICAGO

THE first efforts to remove a strip of adhesive from the skin of a patient are usually futile because its ends

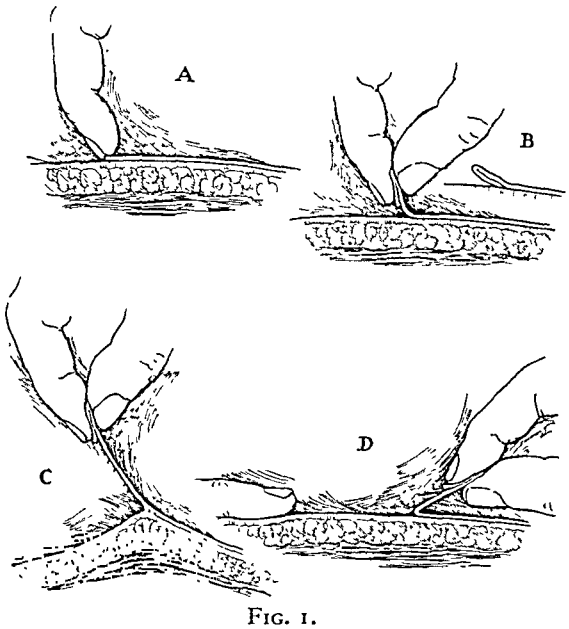


FIG. 1.

adhere too tightly to the underlying skin. The result is usually an embarassing moment for both the physician and the patient; the former is annoyed by his helplessness to grasp the end of the condemned adhesive, while the latter experiences the unpleasing sensation of being scratched just above a tender area by finger nails or the tips of instruments (A in Fig. 1). This can be avoided by the following preventive measure, employed at the time of applying the adhesive. Each end of the strip is doubled about ½ an inch so that the sticking surface is bent inward and pressed together. Thus the end of the adhesive is deprived of its capacity to adhere and can easily be grasped. It is obvious that the attempt to remove such a strip thus treated will cause no difficulties, as illustrated in B.

Another factor usually neglected in removing the adhesive is the direction of the force applied to the free end of the adhesive. The adhesive should never be pulled in a vertical direction, as is usually done when dressing a patient (C). The angle should be about 135°, and one hand should simultaneously stretch the skin in the opposite direction (D). This obviates the unpleasant sensation of painful pinching which occurs when the adhesive is removed at a right angle and consequently pulls up the skin greatly.

It is obvious that lanugo hairs, scarcely noticeable under ordinary conditions, prove themselves an annoyance when their shaving did not precede the application of the adhesive.

CASE REPORTS

APPENDICITIS COMPLICATING PREGNANCY AND LABOR

JAMES F. NORTON, M.D., F.A.C.S. AND JOHN N. CONNELL, M.D., F.A.C.S.

From the Margaret Hague Maternity Hospital

JERSEY CITY, N. J.

THE occurrence of appendicitis during pregnancy, surgically considered, differs in no respects from appendicitis at any other time and reports of isolated cases or small groups of cases are neither interesting nor unusual, and add nothing to our knowledge. It is obvious, of course, that no obstetrical problem is involved when pregnancy in its early stages is complicated by appendicitis.

A case of acute appendicitis with peritonitis, complicating the first stage of labor, prompted us to review the problems of appendicitis as it occurred in 20,000 consecutive deliveries at the Margaret Hague Maternity Hospital. In going over the recent literature we were impressed by several facts:

(1) The paucity of reports emanating from the larger American obstetrical clinics. (2) the relative infrequency of appendicitis in the last trimester of pregnancy, and the grave prognosis accompanying the complication at this time; (3) the much rarer complication of appendicitis occurring during labor and the increasingly grave prognosis; (4) finally, the marked divergence of opinion as to what constitutes the optimum type of obstetrical procedure, particularly if the patient is at term, and more so, if labor has been initiated.

We feel that our experience with this subject, admittedly limited, is worth recording, and assume this to be sufficient warrant for this presentation.

We wish to present in Table 1 a study of all the cases of appendicitis complicating pregnancy, for we feel that, while it may show nothing new, it does present some interesting features.

Table 1 shows 8 cases of appendicitis complicating pregnancy, all in patients thirty years of age or younger; 4 occurred in primigravida, and 4 in multigravida.

The large proportion occurring during the eighth and ninth months of pregnancy, 4 cases, or half the total, is interesting, as this is contrary to the experience of most contributors, who seem uniformly of the opinion that the greatest percentages are in the early months of pregnancy.

Maes,[1] reporting 50 cases from the Charity Hospital in New Orleans, says that the majority occur in the second trimester; Royston and Fisher,[2] presenting a series of 10 cases, show none of the acute type later than the sixth month; Landry[3] says it is much more frequent in the third and fourth months and further adds that during the last two months the problem is a gigantic one.

Heineck[4] made an analytical study of all operated cases of appendicitis associated with gestation reported in the English, French and German literature from 1916 to 1926. His statistics include those cases presented by Jerlov, in 1925, who has had an extensive experience and has written a very comprehensive monograph dealing with appendicitis in pregnancy and the puerperium gathered from Scandinavian sources from 1900 to 1920. From this vast amount of material, Heineck states that the complication is most frequent in the

second, third and fourth months, and is rare in the last few weeks. Marbury[5] says that 80 per cent are in the first six months. D'Erico,[6] reporting 65 cases from various Boston hospitals, shows 4 cases occurring during the last month. Wilson,[7] presenting 10 cases from the obstetrical and surgical services of the Methodist Episcopal Hospital in Brooklyn, had 3 cases in the last trimester.

first evidence of upward displacement of the appendix by the gravid uterus which is found after the third month, and the increased incidence of appendicitis occurring during the second trimester.

From a pathological viewpoint, except for the ruptured gangrenous appendix complicating labor, there did not seem to be any predilection for the severer types of appendiceal involvement to occur late in

Table 1

Case	Name and Number	Age	G	P	L. M. P.	Date of Operation	E. D. C.	Month of Pregnancy	Pathological Diagnosis
I	J. B. 8404	20	I	0	6/ ?/32	2/14/33	3/ ?/33	8th	Acute gangrenous appendicitis
II	T. D. 8382	28	IV	III	7/20/32	4/12/33	4/27/33	9th	Acute purulent appendicitis
III	A. K. 13604	27	III	II	12/28/32	5/ 9/33	10/ 5/33	5th	Acute gangrenous appendicitis
IV	V. D. 12726	30	II	0	12/ 4/32	5/24/33	9/11/33	6th	Acute gangrenous appendicitis
V	E. H. 16179	18	I	0	10/ 9/33	2/ 9/34	7/16/34	4th	Acute purulent appendicitis
VI	H. O. B. 17672	26	II	I	11/30/33	4/10/34	9/ 8/34	5th	Chronic appendicitis
VII	E. T. 20669	23	I	0	5/15/34	1/ 3/35	2/22/35	8th	Chronic appendicitis, subsiding acute
VIII	J. H. 19680	18	I	0	3/21/34	12/21/34	12/28/34	9th	Ruptured gangrenous appendicitis

DeLee,[8] reporting 2 cases which bring to 4 his total of cases observed in thirty years, says "In the last few weeks of gestation and during labor, it is very rare."

Schmid,[9] whose series is one of the largest reported in the literature, reports the majority of his 486 cases as occurring between the third and sixth months of pregnancy, and mentions only 21 cases as occurring at the end of pregnancy.

LeJemtel[10] finds appendicitis to be a complication found mostly in the first half of pregnancy.

Baer[11] et al. report, from the Michael Reese Hospital in Chicago, 28 cases of appendicitis occurring as a complication of pregnancy; 14 patients of this group were operated during the second trimester of pregnancy, 8 during the first trimester, and 6 during the third trimester. They indicate a causal relationship between the

pregnancy, as many believe. As indicated in the table, the case at four months was an acute purulent appendicitis, and one at the fifth and another at the sixth month acute gangrenous appendicitis; 1 case at the eighth month had an acute gangrenous appendicitis; another at the ninth month had acute purulent appendicitis. There were 2 cases of chronic appendicitis, 1 at the fifth, and another at the eighth month.

In none of these cases, excepting the one complicating labor, was any difficulty encountered at operation with the pregnant uterus. No attempt was made in any way to interfere with the progress of pregnancy. These cases offered no special difficulty in diagnosis or surgical or obstetrical management, and in each an appendectomy was performed and drainage used when indicated; the postoperative course of all the cases paralleled that of any case with

appendix and peritoneum similarly involved. None of the early cases aborted and none went into premature labor.

The subsequent obstetrical record of these 8 cases is shown in Table II.

Of the 4 cases in the last trimester, Case I was delivered two days after operation by elective low forceps under spinal anesthesia, and about fourteen days before term.

Table II

Case No.	Date of Operation	Date of Delivery	Relation of Delivery to Operation	Type of Delivery and Anesthesia	Days Morbid Postpartum	Condition on Discharge	
						Mother	Child
I	2/14/33	2/16/33	2 days P. O.	Elective low forceps. Spinal	None	Good	Good
II	4/12/33	4/27/33	15 days P. O.	Normal spontaneous delivery	6	Good	Good
III	5/ 9/33	10/13/33	157 days P. O.	Elective low forceps. Spinal	None	Good	Good
IV	5/24/33	8/ 8/33	76 days P. O.	Normal delivery	None	Good	Good
V	2/ 9/34	7/24/34	165 days P. O.	Normal delivery	None	Good	Good
VI	4/10/34	9/ 3/34	146 days P. O.	Normal delivery	None	Good	Good
VII	1/ 3/35	1/23/35	21 days P. O.	Elective low forceps. Ether	None	Good	Good
VIII	12/21/34	12/22/34	1 day P. O.	Elective low forceps. Ether	5	Good	Good

From Table II it will be seen that we have adopted an attitude of prompt surgical intervention toward appendicitis complicating pregnancy, but have refrained from interfering with the pregnancy in the absence of any definite obstetrical indication. In none of these cases was any accouchement force, bagging, induction of labor or interference of any nature practiced either before, at the time of, or after operation.

It is interesting to note that the morbidity course following the onset of labor was not unusual, considering the pathology of the appendix, even in the cases going into labor on the first and second days after operation. This, it seems, at least holds up to question the position of those operators who claim that, unless the uterus is emptied either before or at the time of the appendicectomy, the uterine activity incident to labor will enhance the spread and diffusion of the peritoneal infection. In none of the cases seen early in pregnancy did abortion or premature labor supervene. All went to term.

Case II was delivered fifteen days after operation by normal spontaneous delivery, ether anesthesia, on her expected date of confinement.

Twenty-one days after operation Case VII was delivered by elective low forceps, ether anesthesia, about four weeks before her expected date of confinement.

Case VIII was delivered by elective low forceps under ether anesthesia one day after operation and was in labor before the operation was begun.

There were no maternal or fetal deaths in this series of 8 cases.

Because of the extreme rarity of gangrenous appendicitis with diffuse peritonitis complicating labor, we submit some statistics from the recent literature.

Table III shows a total of 1110 cases of appendicitis complicating pregnancy, with only 9 cases occurring in labor. The incidence is very difficult to estimate accurately from these series, because one has no way of determining from how many cases of pregnancy these cases were drawn.

TABLE III

Author	Source of Cases	No of Cases during Pregnancy	No. of Cases during Labor
Schmid[9]	Collected from literature for 20 years prior to 1911 plus 28 cases of his own	486	0
Heineck[4]	All cases in English, French and German literature 1916–1926	405	2
Jerlov[12]	Scandinavian hospitals from 1900–1920	Included in Heineck series	0
D'Errico[6]	Various Boston hospitals	65	0
Maes[1]	Charity Hospital, New Orleans	50	0
McDonald[13]	Western Surgical Ass'n	33	0
Baer, Reis[11] and Arens	Michael Reese Hospital, Chicago, Ill	28	0
Wilson[7]	Obstetrical and surgical services, Methodist Episcopal Hospital, Brooklyn, N Y	10	0
Royston and Fisher[2]	Personal series	10	0
Findley[14 15]	Personal series	9	0
Portes and Seguy[16]	Personal series	7	0
Puppel[17]	Personal series	6	1
Barber and Miller[18]	Personal case		1
Grattan[19]	Personal case		1
King[20]	Personal case		1
Krauss[21]	Personal case		1
Le Jemtel[10]	Personal case		1
Marbury[5]	Personal case	1	
Rose[22]	Personal case		1

From this table it is quite evident that there is no lack of statistical reports relating to appendicitis as a complication of pregnancy, and further, that the complication is not unusual. But one must be impressed by these figures, which indicate a total of 1110 cases of appendicitis during pregnancy and only 9 during labor.

The largest series are those by Schmid,[9] Heineck,[4] and Jerlov.[12] In presenting his group, Schmid,[9] from a very detailed study of 486 cases, shows none as complicating labor. Heineck,[4] indicates 2 cases during labor, and while he discusses appendicitis as it occurs within several days of term, he does not go into any great detail concerning appendicitis as a complication of labor. Jarlov,[12] in his report, does not indicate any of his cases as occurring in labor.

Throughout the entire literature on this subject, repeated reference is made to the statement by DeLee,[8] that in thirty years he has seen but 4 cases of appendicitis late in pregnancy.

The incidence of appendicitis with peritonitis complicating labor in our series is 1 in 20,000.

CASE HISTORY

J. H., a primigravida clinic patient, aged nineteen years, entered the hospital at 5:55 P.M. Dec. 20, 1934, in labor which had started at 1:00 A.M. The pains increased in severity throughout the day. Just before entering the hospital, the pains were severe and occurred every five minutes. She had been seen at the prenatal clinic five times, had a normal pregnancy which had progressed uneventfully; her pelvic measurements were normal.

At 7:37 P.M. the fetal heart was of good quality, heard in the right lower quadrant; the vertex was in the brim, the cervix 3 cm. dilated and thinned, with membranes intact.

At 11:00 P.M. it was noticed that, although the patient was a young primigravida and somewhat emotionally unstable, she was having pain out of proportion to the stage of labor. In addition, she was vomiting and looked sick. A note was made on the labor record that the patient complained of pain in the right side. The pain was fairly well localized in the upper part of the right lower quadrant, and the abdomen was tender over the entire right side. It was felt that an acute inflammatory condition within the abdomen had to be considered.

When seen at 12:10 A.M., she presented the following picture: she had continuous generalized abdominal pain, which was accentuated with each uterine contraction, but most severe on the right side. She was nauseated, retched frequently, was very restless, nervous, and unable to cooperate well. Her tongue and lips were dry, temperature was 101, pulse 100 of good quality. The uterine contractions occurred every three to four minutes. On palpation of the abdomen between uterine contractions, very pronounced tenderness and rigidity were found in the right flank at and above the crest of the ilium. Tenderness was also present in the right upper quadrant and left lower quadrant. The rectal examination showed the cervix to be 6 cm. dilated, with the vertex 1.5 cm. above the spines in an R.O.A. position. There was no vaginal bleeding. A catheterized specimen of urine was negative.

The white blood count was 26,600 with 90 per cent polymorphonuclear leucocytes.

The preoperative diagnosis was acute appendicitis with rupture and peritonitis. Operation was done under spinal anesthesia supplemented with ether, after 1500 c.c. of normal saline had been given by clysis.

A 16 cm. right rectus incision was made, higher and more lateral than usual because of the higher location of the appendix as pregnancy approaches term. The muscle was retracted mesially, and the posterior sheath of the rectus and peritoneum was opened. Free purulent fluid welling into the wound was suctioned. There immediately presented a cyst of the right ovary, $10 \times 8.5 \times 6$ cm. in size, twisted twice upon its pedicle which was excised. Pus continued to issue down the right lumbar gutter, and we appreciated that the cyst was but an incidental factor and not the source of trouble. The cecum was located high above the crest of the ilium and the incision had to be extended upward. It required a few minutes search to find the appendix, which had rotated counter-clockwise and was under the liver. The appendix was excised with some difficulty due to its location and bulk of the gravid uterus. Two soft rubber drains were placed, and the abdomen was closed in layers.

The postoperative orders were high Fowler positions, nothing by mouth for forty-eight hours, clyses of 1500 c.c. of 5 per cent glucose and saline every eight hours. Morphine grains $\frac{1}{6}$ hypodermically were repeated every four hours.

Postoperative course: At 12:30 A.M., Dec. 22, after twenty-four hours arrest, labor was suddenly resumed and progressed rapidly. At 2:10 A.M., twenty-four hours after operation, under ether anesthesia an elective low forceps delivery was done with a left mediolateral episiotomy. The baby was narcotized and required the usual artificial help to initiate respiration. The subsequent course of the mother and baby was uneventful and both were discharged from the hospital on the twenty-fourth day after the operation.

Pathological Report: Right Ovary. The gross specimen consists of a round ovary weighing 210 Gms., measuring $10 \times 85 \times 6$ cm. On cross section some clear viscous fluid is discharged. The outer cavity is smooth, pale and skin like; the inner lining is smooth, except where a round nodule 1 cm. in diameter is seen. On cross section, some sebaceous material with dark hair is expressed. The wall in one place measures 0.5 mm., and in other places 2 mm., in thickness.

Microscopical sections of this wall show a lining of high cylindrical cells which form papillary projections of similar lining. The cyst is attached directly to the ovary. Sections of the small nodule show skin like coverings, with hair follicles and sebaceous and sweat glands. There is also cartilage and bony tissue.

The microscopical diagnosis was papillary cystadenoma of the ovary, with an epidermoid cyst.

Appendix: The laboratory report gave the diagnosis of acute purulent appendicitis with acute gangrenous exacerbations, and acute fibrinopurulent periappendicitis.

COMMENT

The difficulties encountered in the preoperative diagnosis, were the ruling out of pyelitis and the determination of the probable extent of the peritoneal infection. There was definite general abdominal tenderness most pronounced above the crest of the ilium on the right side and rigidity which also was more marked on the right side. These abdominal findings were distinguished clinically from the intermittent uterine contractions of labor. The patient could, and would, inform us of the onset of a labor pain. The general nature and extent of the abdominal signs were sufficient to warrant the assumption that we were dealing with a ruptured appendix and a diffuse peritonitis. Pyelitis was quite easily eliminated because of the history, type of pain, radiation, abdominal examination, and the urinary findings.

Surgical and Obstetrical Management: It was deemed wisest to perform an appendectomy with drainage and to leave the pregnant uterus alone; to attempt putting the patient out of labor with morphine and to hope for a vaginal delivery at a later date.

We did not feel that opening the uterus transperitoneally in the presence of a frank and free peritoneal infection was either wise or justified. The finding of the ovarian

cyst with the twisted pedicle offered no serious problem. A Porro section was decided against because of the age of the patient, nineteen years. We accordingly made a right rectus incision, although higher and more lateral than usual proved

We present in Table IV the details of the cases we were able to find in the recent literature of appendicitis complicating labor, and do so to emphasize the divergent methods utilized in the obstetrical management of these cases. King thinks the uterus should

TABLE IV

Author	Anesthesia Operation	Pathology	Method of Delivery	Delivery Hours Before or After Operation	Result	
					Mother	Child
Heineck.....	Appendectomy	Ruptured appendix	Normal spontaneous delivery of non viable child	Delivered before operation	?	Died
Heineck.....	Appendectomy	Pre-perforative stage of gangrene	Normal spontaneous delivery	9 hours after operation	L.	L.
Barber, and Miller.	Gas, oxygen ether; Appendectomy	Acute appendicitis (mild)	Breech extraction	18 hours after operation	L.	L.
Grattan.....	Chloroform; Appendectomy	Acute gangrenous appendicitis; beginning peritonitis	Chloroform; low forceps	9 hours after operation	L.	Died 7½ hrs. P. P.
King.....	Spinal; Appendectomy	Retrocecal, gangrenous perforation	Cesarean section	Section immediately preceded appendectomy	L.	L.
Rose[22].....	Gas, ether; Appendectomy	Acute peritonitis	Normal spontaneous delivery	Delivery immediately preceding appendectomy	L.	L.
Krause.....	Appendectomy	Acute appendicitis; abdomen filled with purulent exudate	Normal spontaneous delivery	6 hours after operation	L.	L.
McDonald...	Ethylene; Appendectomy	Gangrenous appendicitis; free purulent fluid	Cervix dilated manually; version and extraction	Before operation	L.	L.
Finlley.....	No operation performed		Normal spontaneous delivery	An attack of acute appendicitis during labor without operation	L.	L.
Lè Jemtel....	Appendectomy	Ruptured appendix; pus in peritoneal cavity—abundant	Manual dilatation of cervix, then forceps	3 hours after operation	L.	L.
Puppel.....	Peritonitis, appendicitis	Delivery by "expression"	48 hours before operation	Mother died		

later to be both too low and too mesial. The free pus was drained by suction from the abdominal and pelvic cavities, the right cystic ovary and the ruptured gangrenous appendix were removed and drains inserted. Closure was made in the usual manner.

be emptied first, to reduce its size and get away from its bulky interference; he also feels that premature labor is very likely to follow operation, and the activity of the uterus is likely to do much towards breaking down protective adhesions and giving rise to widespread infection. He thinks, too,

that there is likelihood of infection of the placental site through the bloodstream.

McDonald, writing of a case with impending labor, under ethylene anesthesia manually dilated the cervix, and delivered by version and extraction a full term living child. He then followed this by opening the abdomen and performing an appendicectomy.

Barber and Miller operated for the appendicitis at term and interfered in no way with the pregnancy. They gave liberal doses of pantopon in the hope of deferring labor. The opiate did not have any effect on labor except to give the patient a very comfortable first stage. Eighteen hours after operation, a breech extraction was performed.

Grattan's case was first operated for an acute gangrenous appendicitis, and then nine hours after operation was delivered by low forceps under chloroform anaesthesia.

Krauss, in writing of a case with acute appendicitis and an abdomen filled with cloudy purulent exudate and the patient in labor, first performed an appendectomy and in no way interfered with the pregnant uterus. Six hours after operation a normal spontaneous delivery ensued through the birth canal. He says in his discussion that in accordance with the practice of Portes and Seguy (Paris) he always treats the appendicitis and delivery in two separate procedures, following the principles usually applied to each.

Rose,[22] had a case where labor was completed normally, and then immediately after delivery, the abdomen opened and an acute appendix removed.

Rose,[23] presenting a case with an old appendiceal abscess in the last trimester of pregnancy, says that in the presence of a ruptured appendix and pus formation, the consensus of opinion is that it is best to remove the appendix and do a Porro section at the same time.

Many commentators, while presenting no case complicating labor, express themselves quite definitely. According to Maes, "Prompt operation is indicated as soon as the diagnosis is made, or reasonably suspected, and the procedure should be conducted throughout on the basis of sound surgical principals and delivery should be according to obstetric indication."

D'Errico[6] regards the complication of labor following operation as a bad prognostic sign. In all 4 fatal cases in his series, labor followed the operation.

He asks the question "What shall be the conduct in primipara in labor with a ruptured appendix with diffuse peritonitis?" He quotes Jerlov[12] in answer, "There is no indication to perform a hysterectomy in cases complicated by peritonitis . . . the uterus should not be emptied routinely after operation . . . the best results are obtained by waiting for a spontaneous delivery."

Baer et al[11] says, "There is only one treatment for appendicitis; viz. prompt surgical removal regardless of the pregnancy. The pregnancy on the other hand should be left undisturbed regardless of the severity of the appendiceal involvement or the advanced state of the pregnancy." This statement epitomizes our attitude.

From these references one readily appreciates that all who have written on the subject of appendicitis complicating labor stress the complexity of the problem and emphasize the difficulty of a proper interrelationship of the surgical and obstetrical management. This complication is so rare (in our series 1 in 20,000) that it is hardly likely that any one observer will ever see very many cases, and so one cannot point to any large or reasonably extensive personal experience in dealing with it. However, we do feel that sight of good, sound obstetrical practice should not be lost, and we accordingly do not approve of *accouchement forcé*, or the transperitoneal invasion of the uterus through a peritoneal cavity abounding in free pus, if delivery from below can be expected.

A fear expressed by many is that if the uterus is not emptied immediately, the protective barriers which enter to limit the peritoneal extension of the infection will

surely be disrupted when labor does start and a subsequent spread of infection will take place throughout the abdominal cavity. In the cases reported by Barber and Miller, Grattan, Heineck, and Krauss, this apparently did not occur, neither did it happen in our case.

We feel that in the absence of a true obstetrical indication demanding a different attitude, suppurative appendicitis with peritonitis during labor should be regarded as a complication to be handled as at any other time and the labor allowed to continue, with delivery through the birth canal.

SUMMARY

1. Eight cases of appendicitis complicating pregnancy in 20,000 deliveries are reviewed. Of these, 6 were definitely acute.

2. Four occurred in the last month of pregnancy; one was an acute gangrenous appendicitis with perforation and peritonitis complicating labor.

3. With the exception of this one, no unusual difficulty was encountered at operation because of the pregnant uterus, with which there was no interference.

4. None of the early cases aborted or went into premature labor.

5. The morbidity course following labor and delivery was not unusual, nor was peritoneal involvement increased.

6. A case of acute gangrenous appendicitis with perforation and peritonitis complicating labor is presented, with the usual delay in diagnosis experienced.

7. The cecum was located above the crest of the ilium and the appendix had rotated counter-clockwise under the liver, confirming observations by Baer, Reis, and Arens on the location and rotation of the appendix and cecum as they approached term.

CONCLUSION

Acute appendicitis with peritonitis complicating labor, should be managed surgically as it is at any other time, and the labor allowed to continue with delivery through the birth canal, in the absence of an indication requiring a different obstetrical procedure.

REFERENCES

1. Maes, U. *Am. Jour. Obst. and Gynec.*, 27: 214, 1934.
2. Royston, G. D. *Am. Jour. Obst. and Gynec.*, 11: 184, 1926.
3. Landry, B. B. *New England Jour. Med.*, 202: 722, 1930.
4. Heineck, A. P. *Illinois Med. Jour.*, 52: 250, 1927.
5. Marbury, W. B. *Am. Jour. Surg.*, 19: 437, 1933.
6. D'Errico, E. *New England Jour. Med.*, July 6, 1933.
7. Wilson, R. A. *Surg., Gynec. Obst.*, 45: 620–628, 1927.
8. DeLee, J. B. *Surg. Clin. N. A.*, 1: 1003, 1921.
9. Schmid, H. H. *Mitt. a.d. Grenzgeb d. Med. u. Chir.*, 23: 213, 1911.
10. Le Jemtel. *Bull. et mem. Soc. Nat. de Chir.*, 58: 547–548, 1932.
11. Baer, J. L., Reis, R. A., and Arens, R. A. *J. A. M. A.*, 98: 1359–1364, 1928.
12. Jerlov, Emil. *Acta Obst. et gynec. Scandinavia.*, Supplement 4: 7–168; 1925.
13. McDonald, A. L. *Am. Jour. Obst. and Gynec.*, 18: 110, 1929.
14. Findley, P. *Am. Jour. Obst., N. Y.*, 60: 993–1002, 1909.
15. Findley, P. *J. A. M. A.*, 59: 612, (Aug. 24) 1912.
16. Portes and Seguy. *Gynec. et obst.*, 15: 114–124, 1927.
17. Puppel, E. *Zentralbl. f. Gynäk.*, 55: 1826–1830, 1931.
18. Barber, D. N. and Miller, J. R. *Boston Med. & Surg. Jour.*, 193: 720–721, 1925.
19. Gratten, J. F. *Surg., Gynec. Obst.*, 29: 457–461, 1919.
20. King, G. *China Med. Jour.*, 45: 207–211, 1921.
21. Krauss, F. *Munchen. med. Wchnschr.*, 81: 830, 1934.
22. Rose, B. H. *Am. J. Obst. & Gynec.*, 33: 433–434, 1932.
23. Rose, B. H. *Med. Jour. and Record*, 135: 525, 1933.
24. Sellers, N. E. *J. Med. Assn. Alabama*, 3: 242–245, 1934.
25. Babler, E. A. *J. A. M. A.*, 51: 1310, 1928.

FAVORABLE EFFECT OF X-RAY ON UNUSUAL BLADDER TUMOR

REPORT OF CASE

JOHN K. ORMOND, M.D., F.A.C.S.

Surgeon-in-Charge, Division of Urology, Henry Ford Hospital

DETROIT

INSTANCES of successful treatment of malignant bladder tumors by deep *x*-ray are sufficiently uncommon to make the following case worthy of report.

The patient was seen in September, 1933. He was seventy-one years old and had always enjoyed good health previous to his present illness. He complained of burning on urination, marked frequency and urgency almost amounting to incontinence. For several years he had been accustomed to void once during the night, but about two months earlier his frequency had suddenly increased so that he was voiding eight or nine times during the night, and every fifteen or twenty minutes during the day, and urination was always accompanied by burning. He dated this access of symptoms from a wrench which he had given his back lifting a wheelbarrow load of gravel.

His urine had always been clear and there had been no hematuria. For about six months he had noticed a swelling at the right pubic crest which disappeared when he lay down. He had lost about twenty-three pounds during the year.

In addition to the urinary symptoms, he had some epigastric distention and nausea, but no vomiting.

A general physical examination showed a well preserved, vigorous elderly man who did not look his age; there was no elevation of temperature or pulse rate; except for pyorrhea no abnormality was noted in the mouth, nose or throat; the heart and lungs were clear to auscultation and percussion; his arteries were thick and tortuous; and his blood pressure was 130/80. The abdomen was somewhat distended but no masses were palpable; the deep reflexes were normally obtained, and the bones and joints showed no gross abnormalities. There was a right inguinal hernia; varicosities in the legs; and a small pedunculated fibroma of the back. The prostate was symmetrically enlarged and its consistency did not suggest carcinoma.

The urine was clear and showed: a specific



FIG. 1.

gravity of 1.008, positive albumin, no sugar, no blood and very few pus cells. Hemoglobin was 78 per cent, and the leucocyte count was 6400. The blood Wassermann test was negative.

The phenolsulphonaphthalein output was 23 per cent the first hour, and 22 per cent the second; the non-protein nitrogen of the blood was 40.6 mgm. per 100 c.c.

X-rays of the urinary tract showed no shadow suggesting stone.

Catheterization was attempted but the catheter would not enter the bladder. His

urethra was so sensitive that cystoscopy was essayed under general anesthesia. The bladder neck was found to be exceedingly rigid and the capacity of the bladder was so small that a satisfactory examination was not obtained. In fact, the examiner was not sure that the instrument was in the bladder.

Suprapubic cystotomy was done. In the place of the bladder a firm mass was found; so, in order that a satisfactory exploration of the pelvis might be made, the peritoneal cavity was opened. It was found that this mass was the bladder, which was firm, almost hard and shrunken in size. With the radioknife, a circular incision was made suprapubically into this mass, and carried down through the mucous membrane, thus removing a cylinder of tissue. The bladder wall was about 1½ inches thick, inelastic and very firm. The mucous membrane seemed normal and was not ulcerated anywhere, but the capacity of the bladder was reduced to a few cubic centimeters which probably explained the unsatisfactory nature of the cystoscopic examination.

A Pezzer catheter was then inserted into the bladder and the wound closed about it.

Dr. Hartman's report on the microscopic sections of the tissue removed was as follows: "Sections taken from the wall of the bladder show diffuse infiltration by large epithelial cells. These have abundant cytoplasm and large hyperchromatic nucleoli. The infiltration is always diffuse and there is an excess of sparsely nucleated, pink staining hyaline stroma. There is no suggestion of gland formation and nothing that determines definitely whether this is a primary or metastatic carcinoma. Impression: Scirrhus Carcinoma."

A careful examination, including gastrointestinal *x*-rays, was made for evidence of carcinoma elsewhere but none was found.

He was given four deep *x*-ray treatments through different portals. A gloomy prognosis was given to his relatives; and he was sent home with suprapubic drainage.

However, after he returned home, the suprapubic wound closed, his bladder capacity increased greatly, so that there was no great urinary frequency; his weight increased somewhat and he resumed all his former activities. At the last report, August 1, 1935, he was perfectly well, active and busy; nocturia only once each night and not troubled by excessive day frequency.

This is assuredly a most pleasing result. Of course, two years is too short a period to warrant claims of cure, but he has had two years of comfortable life.

And our confidence in the efficacy of *x*-ray therapy in the case of bladder tumors has received a fillip.

A photomicrograph of the microscopic section accompanies this report.

SUMMARY

An unusual kind of bladder tumor, infiltrating the whole bladder wall, was treated by deep *x*-ray with brilliant results. The patient was apparently in perfect health two years later.

LEUKOPLAKIA OF KIDNEY PELVIS AND URETER*

WILLIAM N. TAYLOR, M.D.

COLUMBUS, OHIO

LEUKOPLAKIA of the urinary tract is most often encountered in the bladder, is rare in the kidney pelvis, and is less frequently encountered as a distinct entity in the ureter. The rarity with which it occurs in the kidney pelvis and its unknown etiology make it desirable that all cases be reported in order that data may be accumulated which will eventually throw light upon the unknown factors and possibilities of the disease as well as aid in the early diagnosis and therapy of it. Histologically, the lesion is particularly interesting because it is an ectodermal process existing in tissues that are embryologically mesodermal and entodermal in origin. This phase of the subject accounts for many ingenious theories and conjectures that have been given to explain the occurrence of such a paradox. Clinically, it is a benign lesion. Its importance, however, is increased as evidence accumulates to show that it may play an important part in the development of squamous cell carcinoma in the urinary tract.

We were stimulated to investigate the interesting phases of this subject after encountering the following case.

CASE REPORT

W. F., white male, age thirty-six years, an automobile mechanic was admitted to the University Hospital, December 11, 1933, complaining of frequency of urination, bloody urine and pain in the left kidney region. Frequency of urination began in 1916. It started as a day and night frequency without any other discomfort. It gradually increased in severity for about one year, when burning during urination and terminal pain became prominent. In 1918, he suffered his first attack of left ureteral colic. His urine showed microscopic blood. An *x*-ray picture revealed a shadow in the left kidney region. He suffered from attacks of ureteral colic of varying intensity from 1918 to 1920. Gross bleeding and severe colic continued intermittently until 1922; at that time he entered a large clinic where he was carefully studied for tuberculosis of the kidney. Being discharged without a definite diagnosis, he was informed that they strongly suspected tuberculosis of the left kidney. Frequency of urination, an occasional ureteral colic and moderate intermittent hematuria continued to be prominent symptoms for the following five years.

He entered another clinic in 1927, where he was carefully studied but no diagnosis was made. While there he had his appendix and a left varicocele removed. During the summer of 1930 and 1931, he carried gross blood in the urine constantly for a period of two months. In 1932, he passed a soft concretion. Following which, his bleeding ceased and his bladder symptoms improved. After the stone passed, he noticed that his urine was a dirty milk color, which has been observed many times since. Eight months before he entered the hospital, he noted a marked increase in urinary frequency; hematuria and pain in the left kidney region were more severe and practically constant. The pain radiated into the left groin, testicle and penis. The attacks of pain occurred most frequently at night after retiring. Chills, fever and sweating have been variable symptoms, but they were particularly aggravating during the last two months. Notwithstanding the fact that this man had had marked freqeuncy, dysuria, hematuria and repeated attacks of colic over a period of fourteen years, he has continued to work, except during attacks of pain. He was in a fairly good state of nutrition and had maintained his weight.

The only previous illnesses he had suffered worthy of note were a bilateral otitis media when a child, gonorrhea in 1914, two years before his present trouble began, measles in

* From Urological Department, Ohio State University. Read before the Columbus Academy of Medicine, April 2, 1934.

1919 and influenza in 1920. He denied a primary sore.

Physical examination revealed a well developed, white male, 5 feet, 8 inches, in height. He appeared anemic. There was a deviation of the nasal septum to the right, and enlarged turbinate bones which occluded the nares. His ears were normal; his teeth were in good condition; the tongue and buccal cavity were normal; his throat slightly injected; the chest was negative on all examinations; heart was normal with the exception of soft systolic murmur at the apex; blood pressure was 132/90.

Examination of the abdomen was negative except for tenderness elicited on palpation over the left lower quadrant, the left flank and costovertebral angle. External genitalia were normal; the prostate was small and tender on palpation; the extremities and reflexes were normal.

The urine was alkaline, specific gravity 1.020; albumin ++; no sugar, no casts; pus cells +; red blood cells +++. A stained sediment showed gram negative cocci and much epithelial debris. The phenosulphonephthalein output was 25 per cent the first hour and 15 per cent the second hour. His hemoglobin was 48 per cent, red cells 3,570,000 and white cells 6,800; the blood sedimentation was very rapid. The non-protein-nitrogen was 45 mg. per 100 cc. of blood. The Wassermann and Kahn tests were negative.

Cystoscopic examination revealed a marked diffuse cystitis, a very irritable bladder which contained a large amount of gray flaky material and pus. The right ureteral orifice was injected, the left was "golf hole" and markedly edematous with some superficial ulcerations about it. Both ureters were catheterized easily. The urine from the right kidney was normal. Urine from the left kidney was a dirty milk color, albumen ++, pus cells ++, red blood cells ++. No bacteria were obtained on smear or culture from the right kidney, but gram negative cocci were found in culture and smear from the left kidney. Indigo carmine given intravenously appeared on the right side in two minutes in a concentration of 3; on the left side it appeared in three minutes in a concentration of less than 1.

A flat plate of the urinary tract shows some pale shadows in the left kidney region which were interpretated as areas of calcification in the renal parenchyma. The left pyelogram showed a moderate hydronephrosis with fuzzy borders which entirely included the calcified areas. No ureterogram was obtained.

Our preoperative opinion of this case was that we were dealing with a chronic tuberculosis with marked secondary infection, stone formation or calcification. We probably leaned toward this idea because of the fact that he had spent time in two large clinics where a persistent effort to confirm a clinical diagnosis of tuberculosis failed. The history, with the small irritable bladder, "golf hole" ureter, and a hydronephrosis with a feathery border, was responsible for our preoperative diagnosis of tuberculosis of the kidney, although we were unable to find the tubercle bacillus.

At operation the fatty capsule was small in amount and showed evidence of chronic perirenal infection and was removed with difficulty from the surface of the kidney, which showed evidences of old and new infarcts. It was normal in size, firm in consistency, and much paler than normal. A great deal of difficulty was experienced in freeing the pelvis and ureter from a large amount of chronic inflammatory and edematous fatty tissue. The ureter was encircled throughout with this same tissue. The ureter measured about ¾ inch in diameter. Upon palpation it gave the sensation of a thick, firm, edematous but elastic tube. Palpation did not reveal the induration of an advanced tuberculosis but rather the sensation of palpating a tube of art gum. The upper third of the ureter was removed. The kidney pelvis was dilated and the wall was very thick and elastic. From gross observation of the kidney and ureter, we were still of the opinion that we were dealing with tuberculosis until the kidney was sectioned. The pathologist's (Dr. Harry L. Reinhart) report was as follows: "Grossly the specimen consisted of a kidney and a portion of the ureter. The kidney measured 7 cm. in length and weighed 180 grams. The pelvis of the kidney was moderately dilated, as well as the ureter. A moderate amount of edematous perirenal fat was removed with the kidney. Upon removal of the fat multiple renal infarcts, both old and recent, were noted on the surface of the kidney. Upon sectioning the kidney, there was an irregular yellow stone about 1 cm. in diameter in a calyx of the lower pole, while similar smaller stones were embedded in a dilated purulent calyx of the upper pole. There were multiple smaller

stony particles present throughout the pelvis and calyces. The pelvis was dilated and entirely covered by a membrane which was firmly adherent. (Fig. 1.) The membrane was grayish white, irregular, and rough due to the many folds which it presented. It had an occasional miliary stone embedded in it. It was stripped from its base with difficulty, leaving a red, granular, irregular surface. The minor calyces and renal papillae were entirely free of it, but contained pasty masses of partially organized yellow gritty material. The cortex was pale, markings indistinct, and averaged about 7 mm. in thickness. The medulla was not remarkable. The infarcts noted on the surface were prominent on cut section.

"Microscopically there were multiple infarcts, diffuse fibrosis, lymphocitic infiltration of the kidney and hyaline degeneration of the glomeruli. The mucous membrane of the kidney pelvis showed complete epidermoidization, with keratinization, marked thickening, and active hyperplasia. (Fig. 2.) There were also irregular depositions of calcium in the membrane. There was marked subepithelial infiltration of plasma cells, lymphocytes and eosinophiles upon a granulomatous base. The ureter showed essentially the same pathology as the pelvis. The microscopic diagnosis was: (1) chronic pyelonephritis; (2) multiple infarcts of the kidney, old and recent; (3) leukoplakia of renal pelvis and ureter."

Follow up on this patient shows complete recovery from symptoms. Three cystoscopic examinations show marked bladder improvement and a normal right kidney. At times a few pus cells are found in the urine which may come from the remainder of the ureter, which is involved. He refuses to have it removed.

The disease was first described by Rokitansky[1] in 1861. Lowenson[2] reported a specific case of leukoplakia in the bladder as early as 1861, but it was not until twenty years later that Ebstein[3] reported the disease in the kidney pelvis. The first report to appear in American literature was by Beer[4] in 1914. Excellent presentations on the subject have since been made by Kretschmer,[5] Richey[6] in 1920, Cumming[7] in 1923, Hinman[8] in 1924. In May of 1929, Kutzmann[9] reported a case of leukoplakia of the kidney pelvis, and after a very complete review of the literature, collected 67 cases, including his own. Since his review, 4 cases have been reported. Culver and Baker[10] in 1930; Potts,[11] 1932; Arlotta,[12] 1932; Reynolds and Howard,[13] 1933 each reported a case to bring the total to 71. The author's case makes a total of 72.



Fig. 1. Note irregular white membrane and a mass of the gritty material that surrounded the papilla.

Due to a lack of any specific evidence to explain this remarkable tissue change, various theories have been advanced. Early observers thought it was secondary to constitutional diseases. Thus it was thought at that time that leukoplakia of any mucous membrane probably had a syphilitic background and there were a few cases of leukoplakia of the kidney pelvis reported in which the authors believed that syphilis did play a primary causative role. Local diseases of the kidney and pelvis were at times thought to produce it but it is evident that the common diseases occur entirely too frequently without leukoplakia to assign them as a causative factor in its production; these associated diseases could well be secondary to leukoplakia.

However, it is a significant observation that infection, stone and obstruction have played a prominent role in practically all cases reported. The disease is most often found in a kidney pelvis which has suffered a long standing chronic irritation, and all the theories advanced to explain its causation have one main idea and that is that the process is a protective one on the part of the mucous membrane. The idea that leukoplakia is the result of the mucous membrane trying to protect itself against destruction is suggested by Hinman, Gibson and Kutzmann, who believe that leukoplakia is a protective cornification; that epithelium possesses a dual potentiality (1) that it differentiates and exercises a normal function according to location but (2) has the inherent ability to call forth a protective mechanism in a uniform way in the presence of irritants.

Haythorn[14] after a study of leukoplakia of the bronchi concluded that the mucosa being destroyed beyond the hope of specific regeneration, sought to protect itself with the best reparative cells it could produce; hence, this hyperplastic, squamous cell membrane. He further pointed out that if the basement membrane was destroyed by irritants, the way was opened for hyperplasia beyond the basement membrane, which would favor the development of new growths, especially squamous cell carcinoma.



FIG. 2. Showing epidermoid transformation and keratinization.

Richey suggests that this change in the histology of the mucous membrane results from its trying to adapt itself to a new environment.

Ribbert[15] also believed that the type of abnormal pathology in surrounding tissues was a factor in determining the type of cell regenerated.

Leber[16] believed the process a protective one against a specific bacterial irritant because he found the same bacteria on the leukoplakia of the renal pelvis as on the xerosis of the conjunctiva. However, no one has been able to prove that a specific bacterium or bacterial toxin can produce such a cornified mucous membrane.

The practical way of looking at the lesion is that it is a protective mechanism against an irritant, but if this is so, it certainly occurs too infrequently for the ordinary irritants such as infection and stone to be assigned specific roles.

It is, therefore, evident that some other factor is responsible for the lesion. The assumption by some men that ectodermal tissues in some way gained a foothold in the lining membrane of the kidney pelvis has been advanced. Thus, it was thought that the epithelial extension to the urinary tract could take place through fistulas, a remote possibility which has been discarded.

Lecene[17] advanced the idea of epithelial cell rests, which might occur owing to the complex development of the Wolffian body and its close relationship with early ectodermal tissues. This congenital misplacement of ectodermal tissues is supported by Staehlin[18] and others who believe that the anterior portion (Pronephros) of the Wolffian body is of ectodermal origin. The excretory duct of the Pronephros has been shown to be included in the ectoderm. Because of these early complicated embryonical contacts of the developmental tissues of the urinary tract with ectodermal structures, it was believed that many opportunities were afforded for inclusion of nests of ectodermal cells along the urinary tract. Ribbert believed that this was the logical explanation of the entity, and added that these cells may appear normal in their location but possess embryonic potentialities, and that they may be only partly differentiated, and, therefore, undergo changes more readily.

Investigations that support the congenital phase of its origin are those of Lavonius[19] who found 5 cases in 150 kidney pelves examined in which the conformation of the epithelium was such that it might give rise to leukoplakia. Heymann[20] noted small areas of cornification in the bladder mucosa in 10 or 20 cases examined. Albarran thought these areas congenital in origin and capable of giving rise to leukoplakial changes.

While such data is relatively meager to support the theory of cell rests, nevertheless, the idea cannot be discarded until further evidence disproves it, or until other theories, such as metaplasia, gain further support.

The most interesting phase concerning the origin of leukoplakia centers about the phenomenon of metaplasia. The normally developed adult epithelium of the urinary tract maintains specific functional and structural characteristics under normal conditions. Abnormal conditions may stimulate these cells to assume the characteristics of another type. The type, cause, and manner of this call change has given rise to much speculation. Virchow[21] first used the term, "Direct Metaplasia," to denote the direct change of one cell into another cell architecturally different but still maintaining some structural characteristics.

Schridde[22] states that the formative cells of the growing epithelium may give up their specific attributes and revert to a cell which has all the powers of differentiation possessed by the embryonic cell from which the epithelium was developed or, "Indirect Metaplasia."

Orth[23] has given us a definition of metaplasia that is more accurate and fits the pathological findings more satisfactorily when he says that it is a transformation of a well characterized tissue into another, equally well characterized but morphologically and functionally different.

The development of leukoplakial tissue through metaplastic processes means that there is no analge of ectodermal tissue present preceding its development. It signifies a direct or indirect change of the transitional epithelium of the pelvis to one with epidermoidal characteristics. Those, who believe in the congenital origin, state that small nests of ectoderm are couched in the transitional epithelium and as a result of irritants become cornified, and that the process extends from these nests and replaces normal mucosa as it is destroyed.

Wolbach and Howe[24] found the urinary mucosa involved at times with a stratified keratinizing epithelium comparable

to leukoplakia where a diet that was deficient in vitamin A was fed to rats. They found the epithelial structures the earliest to be affected by vitamin A deficiency. They concluded from their observation that, "the sequences are atrophy of the epithelium concerned and the substitution for it of a stratified keratinizing epithelium identical in appearances in all locations and arising from focal proliferation of basal cells." They believe that vitamin A deficiency results in epithelial starvation and atrophy, which stimulates a reparative proliferation of basal cells which alone are capable of multiplying in epitheliums with secretory functions. The new, or reparative, cells which replace the old in all locations and regardless of previous functions and morphology acquire a common form and arrangement, that of a stratified keratinizing epithelium.

Wolbach and Howe further observed that it was the basal layer of cells, which correspond to the stratum germanitivum of the skin, that was capable of producing the keratinized layers when vitamin A was withheld as well as reproducing the normal epithelium when it was supplied. Evidently these cells preserve the identity of the original epithelium during the metaplastic period, and can reassume their original function and morphology when it is supplied.

It is interesting to note that this deficiency lesion is a distinct entity and originates without any of the irritative factors often observed by the clinician in leukoplakia of the kidney pelvis, such as infection and stone, which are often considered as etiological factors. Practically all of the histological studies of leukoplakia of the kidney pelvis reported emphasize the cellular infiltration underlying the keratinized membrane.

Wolbach and Howe particularly emphasize the fact that, "the metaplasia of A deficiency in rats, guinea pigs, and human beings does not excite an infiltration reaction, no matter how long the deficiency has continued unless secondary infection has occurred, and that vitamin A deficiency does not increase susceptibility to infection by bacteria. . . . " Practically, these experimental facts fit in nicely with clinical findings. It is doubtful whether any symptoms are initiated by an uncomplicated leukoplakia of the kidney pelvis. It is only after infection has occurred, or tumor and stone formed, with their attendant symptoms that patients have presented themselves for examination. However, before much weight can be attached to this type of keratinization of epithelium, evidence is needed to support it clinically in case of deficiency of vitamin A in man. Again it should be known whether the processes are identical and lastly can similar processes be initiated by separate and distinctly different types of irritants, one of which is constitutional and the other local.

The clinical significance of leukoplakia of the urinary tract is its not infrequent association with squamous cell carcinoma. It has always been considered a precancerous lesion regardless of location and evidences accumulating to show that it may precede carcinoma of the kidney pelvis.

Patch[25] has recently made a study of 152 cases of squamous cell carcinoma of the kidney and bladder; in 13 cases leukoplakia was associated with the malignancy. In his own cases he was able to demonstrate the transitional stages from leukoplakia to malignancy; Hinman has suggested the same relationship. It is possible that the leukoplakia may have preceded the malignancy in a larger number of cases but was not evident at the time the tumor was discovered, due to its replacement by the malignant process. Squamous cell carcinomas have also been reported associated with leukoplakia in the kidney pelvis; thus, Kutzmann found 8 malignancies in 67 cases, only 5 of which, however, were squamous cell carcinoma. Potts has recently reported another making this particular type of tumor occur in 8.4 per cent of renal leukoplakias. We

suspect that this percentage is too low, as it is possible that the leukoplakia occurs more frequently than reported in malignancies of the bladder and kidney because as a precancerous lesion it may be overlooked or entirely replaced, while the malignant tendencies of a leukoplakia may be overlooked due to insufficient examination of the specimen.

Clinically, leukoplakia is not peculiar to any age group. Leber reported it in a patient of four years and Halle one at seventy years of age, the majority occurring between thirty and fifty. It occurs about equally in either sex but there is a preponderance of unilateral lesions which add some comfort insofar as therapy is concerned. It has occurred as a bilateral lesion but three times in 57 of 72 cases reported including the author's.

The symptoms accompanying the lesion are usually those of infection, stone or tuberculosis which so completely dominate the picture that leukoplakia is unsuspected. The patient usually presents a history of a chronic urinary infection with or without stone formation of long standing. In our case such symptoms existed over a period of sixteen years. An analysis of Kutzmann's collection and 5 additional cases show the following clinical and diagnostic data to point to infection as responsible for the preponderance of symptoms and diagnosis. Thus, 45 cases had a cystitis; 41 pyonephrosis; 28 stone; 32 hydronephrosis; 10 tuberculosis and 9 carcinoma. Such lesions cannot help but emphasize their importance as etiological factors in the production of leukoplakia of the renal pelvis. However, one must not loose sight of the fact that leukoplakia is a pathological process at the same time that it is probably playing a physiological role (Hinman and Gibson) and may have preceded the associated pathology, whether infection, stone, or tumor.

The lesion is seldomly diagnosed before operation or autopsy as the only clinical indication of it is the passing of cornified epithelial plaques in the urine. Beer and Stockman[25] have reported such findings. Our patient gave a history of passing dirty, gray urine at times and we examined such a specimen but the presence of pus and blood caused us to pay no attention to the epithelium present. Hematuria was a prominent symptom in our case and was reported in 35 per cent in Kutzmann's collection. Hematuria, however, in the presence of other evident pathology would carry little diagnostic significance.

The lesion produces no painful symptoms except where obstruction from masses of epithelium, pus, or stone are blocking the ureter or where there is a stricture of the ureter. One observation that may give a clue to the lesion in the kidney is the presence of leukoplakia in the bladder. In 72 cases herein collected, 6, or 8.3 per cent, presented bladder leukoplakia. The presence of a leukoplakia should be suspected in long standing irritating lesions of the kidney pelvis.

The treatment of leukoplakia is usually directed at the associated pathology which is very often extensive and unilateral; in such cases nephrectomy is indicated. If the lesion is diagnosed, it should require nephrectomy on the basis of a precancerous lesion. Finally, if the lesion is bilateral, palliation in the form of promoting drainage to the kidney pelvis and lavage to lessen the infection are indicated.

SUMMARY

1. Another case of leukoplakia of the kidney pelvis is reported and 4 additional cases collected from the literature making a total of 72.

2. The cause of this tissue change is unknown; the theories advanced to explain it are:

(a) Congenital displacement of ectodermal cell nests;

(b) Metaplasia of the normal mucosa from local or constitutional irritants. Clinically, the influence of infection, and stone is probably the most significant factor in initiating the lesion.

3. Our case was characterized by:
 (a) Long standing infection, stone, hematuria, and pain;
 (b) Incorrect diagnosis of tuberculosis;
 (c) The finding at operation of a large amount of edematous fibro-fatty tissue surrounding the pelvis and ureter;
 (d) Microscopically, the absence of carcinomatous changes.

4. The treatment when unilateral is nephrectomy.

REFERENCES

1. Rokitansky. Lehrbuch der pathologische Anatomie. Ed. 6, 1861, vol. III, p. 354.
2. Lowenson. Ueber einen bes. Folgezustand der epidermoidalen Unwandlung des Harn-Blasenepithels. *St. Petersb. med. Ztschr.*, 2:225, 1862.
3. Ebstein. Zur Lehre von den chronischen Katarrhen der Schleimhaut der Harnwege und der Cystenbildung in denselben. *Deut. Arch. f. klin. Med.*, 31: 63, 1882.
4. Beer, E. Leukoplakia of the pelvis of the kidney and its diagnosis. *Am. Jour. Med. Sci.*, 147: 244, 1914.
5. Kretschmer, H. Leukoplakia of the kidney pelvis. *Arch. Surg.*, 5: 348 (Sept.) 1922.
 Leukoplakia of urinary organs. *Surg. Gynec. Obst.*, 47: 145, 1928.
6. Richey. Leukoplakia of the pelvis of the kidney: a study in metaplasia. *J. Lab. & Clin. Med.*, 5: 635, 1920.
7. Cumming. Leukoplakia of renal pelvis. *Surg. Gynec. Obst.*, 36: 189, 1923.
8. Hinman, F., Kutzmann, A. A. and Gibson, T. E. Leukoplakia of the kidney pelvis. *Surg. Gynec. Obst.*, 39: 472, 1924.
 Hinman, F., and Gibson, T. F. Squamous cell carcinoma of the bladder. *J. Urol.*, 6: 1, 1921.
9. Kutzmann. *Arch. Surg.*, 19: 871, 1929.
10. Culver, H. and Baker, W. J. *Transactions Am. Assn. Genito-Urinary Surgeons*, 23: 151, 1930.
11. Potts, W. J. Squamous cell carcinoma of renal pelvis associated with stone and leukoplakia. *Arch. Surg.*, 25: 458, 1932.
12. Arlotta, M. Leukoplakia of renal pelvis. *Arch. itol. di. chir.*, 32: 525, 1932.
13. Reynolds, R. and Howard, N. J. Pelvis leukoplakia in horseshoe kidney. *J. Urol.*, 653–664 (Dec.) 1933.
14. Haythorn. On the metaplasia of bronchial epithe um. *Jour. Med. Research*, 26: 523, 1912.
15. Ribbert. Ueber Umbildungen an Zellen und Geweben. *Virchow's Arch. f. path. Anat.*, 157: 106, 1899.
16. Leber. Ueber die Xerosis der Bindehaut und die infantile Hornhaut-verschwarung. *Arch. f. Opbth.*, 29: 205, 1883.
 Ueber die Zerosis der Bindehaut und die infantile Hornhautverschwarung nebst Bemerkungen uber die Entstehung des Xerophthalmus. *Deut. med. Wchnschr.*, 10: 206, 1884.
17. Lecene, P. Un cas de leukoplasie du bassinet. *J. d'urol.*, 1: 129, 1913.
18. Staehlin. A study of multilocular cyst-adenomata of retroperitoneal origin. *Ann. Surg.*, 6: 312, 1915.
19. Lavonius. Cited by Kutzmann.
20. Heymann. Cited by Kutzmann.
21. Virchow. Ueber Metaplasie. *Virchow's Arch. f. path. Anat.*, 97: 410, 1884.
22. Schridde. Cited by Kutzmann.
23. Orth, J. Cited by Kutzmann.
24. Wolbach, S. B., Howe, P. R. Tissue changes following deprivation of fat-soluble A vitamin. *J. Exper. Med.*, 42: 753, 1925.
 Epithelial repair in recovery from vitamin A deficiency. *J. Exper. Med.*, 57: 511, 1933.
25. Patch, F. S. The association between leukoplakia and squamous cell carcinoma in the upper urinary tract. *New England J. Med.*, 200: 423, 1929.
26. Stockmann, F. Ein Fall von epidermoidaler Metaplasie der Harnwege. *Zentralbl. f. d. Krankh. d. Harn- u. Sex-Org.*, 13: 621, 1902.

NINETY-SEVEN POUND FIBROMYOMA UTERI*

REPORT OF CASE

W. S. WHEELING, M.D., AND J. A. ORRIS, M.D.

Chief Surgeon, Windber Hospital

Associate Surgeon, Windber Hospital

WINDBER, PA.

A RESUMÉ of the literature concerning fibroids of the uterus both of the solid and cystic form has shown many large tumors to have been removed successfully with complete recovery. The case which we wish to present was a ninety-seven pound fibroid tumor with some cystic degeneration at the lower part and, as far as we can learn, is two pounds heavier than any of the other fibromyomata which have been successfully removed. Cocram[1] in 1911 reported having removed a ninety-five pound solid myoma from which the patient made an uneventful recovery.

We are grateful for Owings,[2] of Baltimore, review of "Large Cystic and Solid Uterine Myomas" reporting 33 cases weighing over thirty pounds. The following data is gleaned from his résume: The mortality rate of the entire series was 21.4 per cent. In the 25 cases whose ages were known they varied from twenty-three to sixty-five years of age, in 20 of these cases it was from thirty-five to fifty-nine years. In 24 cases where the duration of symptoms were available, 9 had symptoms twenty to twenty-six years, 6 had symptoms ten to eighteen years, 7 had symptoms five to eight years; while the 2 remaining cases had symptoms eight months and one year respectively, these latter cases being fibrocystic and cystic myomata. Of the 33 cases, 21 were true myomata or fibromyomata of either a soft or solid nature, the 12 remaining cases were cystic or fibrocystic in nature. Of the 33 cases, 6 died a few hours to six days following operation, one died six days after paracentesis, 2 of the tumors are the reports of autopsies, in one of the cases the result was not given, in another case the recovery was given as questionable, 22 of these cases were reported as recoveries following operation.

"A cystic fibroid weighing forty-seven pounds and simulating an ovarian cyst," reported by Greenhill,[3] was removed at autopsy, the patient having succumbed from an acute illness. There was a history of the patient having had seventy-five paracenteses in the past year. Upon opening this tumor he states that four quarts of a very foul smelling fluid was obtained.

REPORT OF CASE

Mrs. M. K. aged forty-eight years, white, married, complained of a large abdominal mass; pain in the abdomen and back while standing or walking; nervousness; loss of weight; weakness; insomnia; and cramps in the feet and legs.

Family History: Her mother died at the age of sixty-six years following an accident. Her father died at the age of seventy-two years of pneumonia. Six sisters were living and well, one had a goiter removed successfully. Four brothers were living and well. Four sisters died, one of meningitis; one accidental; and 2 of diphtheria.

Personal History: She had measles, mumps, chickenpox, whooping cough, diphtheria, several attacks of bronchitis, pneumonia on two occasions and influenza in 1919. The patient has had nocturia two to three times a night for the last two years and also has to urinate immediately upon turning on her right side in bed.

Operations: She had an appendectomy in 1920.

Menses were established at eleven years of age, always regular until six years ago follow-

* From the Department of Surgery, Windber Hospital.

ing the death of her child, when she began to menstruate rather profusely and continued to do so for six months, and have been somewhat more profuse to the present time. She has had a continual clear and watery discharge since that time which has on occasions been slightly blood tinged.



FIG. 1. FIG. 2.

FIG. 1. Side view of patient on August 2, 1934; weight 177½ lbs.

FIG. 2. Front view.

Marital: The patient has been married eighteen years. She had one child which died at the age of eight years, six years ago. She has had no miscarriages or abortions. Her husband is living and in good health.

Present Illness: Following the birth of her only child in 1920 patient began to have bearing down pains and quivering sensations in her lower abdomen. In 1925 she noticed a mass in her left lower quadrant which she states was about the size of a pineapple. Since this time the abdominal pain has increased in severity and the mass has continued to enlarge. The patient states that her weight in 1924 was one hundred eighty-four and one-half pounds. Together with the loss of weight she has also suffered from insomnia, weakness, nervousness and cramp like sensations in her legs and feet. Up until the present time she has been able to do the greater part of her housework with some assistance from the members of her family.

Physical Examination: The patient was lying in bed on her left side. The patient is of a rather tall stature, five feet, eight and three-fourth inches in height; emaciated in appearance; skin is dry with poor elasticity; the eyes

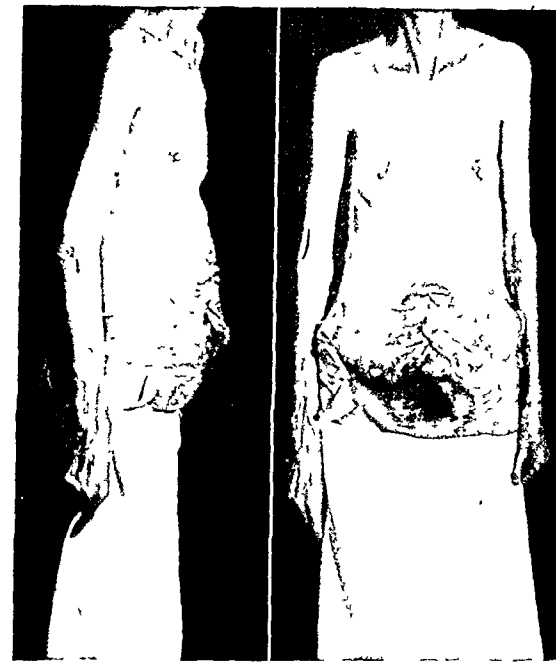


FIG. 3. FIG. 4.

FIG. 3. Side view of patient on Sept. 16, 1934, one month after operation. Weight 97½ lbs.

FIG. 4. Front view.

are markedly sunken; pupils are equal; react to light and accommodation and when standing her posture was quite stooped due to the weight of the tumor. There are some carious teeth present. The neck is thin, long and scrawny. There is marked emaciation of the entire chest wall, the scapula, clavicles and sternocleidomastoid muscles are quite prominent. The breasts are atrophied. Excursion of the chest is equal bilaterally on inspiration, as is vocal fremitus. The chest is resonant; the breath sounds are clear and no rales are heard. The apex beat of the heart is in the fifth interspace slightly outside the midclavicular line. The heart sounds are slightly more distant than normal; there are no shocks, thrills or murmurs present. The blood pressure is 118/78.

Abdomen: There is a large pendulous abdominal tumor producing a protrusion of the abdomen from the lower costal margin and extending approximately to the upper level of the patella. There is a large tortuous vein beginning at the xiphoid process and extending over the anterior surface of the

abdominal wall slightly to the right of the umbilicus and terminating at its lower portion. The skin is somewhat pigmented and rather

anisocytosis, few microcytes, occasional poikilocytes and marked achromia.

August 2, 1934, the weight of the patient



Fig. 5.



Fig. 6.



Fig. 7.

Fig. 5. Gross appearance of large fibroid which had been removed one month previously. Weight of tumor is 65 lbs. The white stick seen on the right side of the tumor enters the uterine cavity and represents the point of excision with the upper portion of the uterus.

Fig. 6. The portion seen slightly below the white strip of paper represents the attachment of the left Fallopian tube and ligaments.

Fig. 7. Sectioned in midportion in the same plane as the rulers seen in Fig. 6. The greater part of the tumor is of the compact fibroid material; at the lower portion there is considerable cystic degeneration.

thick. On palpation the mass is firm with the exception of an area about 4 inches from the xiphoid to the upper margin of the tumor which is soft and which on percussion is tympanitic. The tumor mass is firm on palpation over its greater portion with some suggestion of an increased softening at its lower portion. The entire mass is flat on percussion.

Extremities: The arms and legs are quite long and emaciated. There is no evidence of any swelling, edema or clubbing. There are no tremors present. Reflexes are normal.

Temperature was persistently between 98.2° and 101° previous to operation but gradually fell to normal following operation.

The urine was one plus for albumin on admission with many pus cells and on one occasion, two days after operation, there were granular casts, blood and an increased amount of albumin present. At the time of her discharge, however, the urine was practically negative with the exception of faint traces of albumin.

Blood count: August 2, 1934, showed red cells 3,130,000, with hemoglobin 39 per cent and color index of .62; white cells 13,400 with a differential of polymorphonuclear 82 per cent, segmented 76; small lymphocytes 14 per cent stab. 6; large mononuclears 1 and eosinophiles 3. The red blood cells showed considerable

was 177½ pounds.

August 4, 1934, 425 c.c. of blood was given by the Unger method.

August 7, 1934, *incision and drainage* was done under local anesthesia on the anterior abdominal wall slightly to the right and about 4 inches below the umbilicus. An incision made through the skin, fascia, and small amount of muscle tissue revealed a pearly, transluscent and fairly thick membrane. When this membrane was incised, the finger was inserted and a fairly large amount of cloudy amber fluid exuded; a rubber tube was inserted and sutured to the skin for drainage.

August 9, 1934: 450 c.c. of blood was transfused by Unger method.

August 16, 1934: *Operation:* Under local anesthesia an elliptical incision was made about two feet in length, incorporating the umbilicus and the previous incision which had been made for drainage. The skin and fascia together with the parietal peritoneum of the incision were removed after separating the peritoneum which was adherent to the cyst wall. The bladder was rather high and somewhat adherent to the lower pole of the tumor and the left broad ligament. The left Fallopian tube and round ligament with the broad ligament were adherent to the lateral and posterior wall of the tumor mass. The left ovary could not be

identified. The left adnexa was enlarged to about the size of a child's arm and contained a rather large plexus of veins. These were clamped and ligated from their attachment together with the broad ligament which seemed to encase a portion of the tumor. There was also considerable cystic degeneration of the left broad ligament and tube. The tumor was then approached from its upper portion, adhesions being separated between the omentum and the tumor wall; at its lower portion the tumor was continuous with the uterus. It was necessary in the removal of the tumor therefore to excise the greater portion of the fundus of the uterus. The denuded surface of the uterus was approximated and other denuded areas were peritonealized, the vessels being secured with suture ligatures. Before attempting closure of the abdomen, a moderate amount of cystic degeneration of the peritoneum present, was excised. The abdomen was closed with continuous doubled No. 1 catgut incorporating the peritoneum, fascia and muscles with the same suture due to the thinness of the abdominal wall. The skin was closed with continuous equisitine suture.

August 21, 1934: 500 c.c. of salt solution and 500 c.c. of 10 per cent glucose were given intravenously.

PATHOLOGICAL REPORT

Gross Description: Specimen consisted of a large, irregularly shaped solid tumor mass. It weighed 65 pounds and measured 40 × 32.5 × 20 cm. No normal uterine or ovarian tissue could be found.

The external surface of the mass was smooth and shiny and was extremely vascular. Upon section, the tumor was found to present a varying structure. There was a dense outer layer measuring about 0.5 cm. in diameter completely surrounding the mass. The inner part of the tumor had the appearance of a fibroid which had undergone degeneration. In some areas it was extremely firm and was whitish; in other parts the tissue was soft and pink; in still other regions degeneration had occurred and the cystic places contained a pseudomucinous material. There were a few areas of calcareous degeneration.

Microscopic Description: The tissue was composed essentially of interlacing bundles of smooth muscle and fibrous tissue characteristic of uterine fibroid. The tumor was quite cellular but did not have the appearance of being malignant. There was considerable vascularity. At one area there was cystic formation and colloid degeneration in another.

Final Diagnosis: Fibromyoma uteri with cystic degeneration.

From the following data the weight of the tumor was deduced:

Weight of patient on admission, August 2, 1934	177½ lbs.
Weight of patient on September 5, 1934, 20 days postoperative	89 lbs.
Weight of tumor removed August 16, 1934	65 lbs.
Fluid obtained by drainage through incision August 7, 1934	14 lbs.
Fluid obtained by drainage from August 7 to August 16	18 lbs.
Total weight of tumor therefore was	97 lbs.
Gain in weight of patient in twenty days following operation	8½ lbs.

The patient continued to improve and gain weight; the following are weights recorded at later dates:

Weight on September 16, 1934	97½ lbs.
Weight on September 26, 1934	106½ lbs.
Weight on November 10, 1934	129 lbs.
Weight on November 28, 1934	134½ lbs.
Weight on December 14, 1934	141½ lbs.
Weight on May 24, 1935	148½ lbs.

These figures not only show the weight of the tumor but they also show the rapid convalescence which was made following operation.

Comment: We consider this case of interest because of its unusual size and the uncomplicated recovery which this patient has made. The physical condition of this patient perhaps was better than those which have been reviewed and because of this the outcome has been favorable.

REFERENCES

1. Cocram, H. S. *New Orleans Med. and Surg. Jour.*, 43: 591, 1910–1911.
2. Owings, James C. Fibromyoma of the uterus. Report of a case of sixty-five pound solid fibromyoma, with a review of large cystic and solid uterine myomas. *Arch. Surg.*, 27: 879 (Nov.) 1933.
3. Greenhill, J. P. Cystic fibroid weighing forty-seven pounds and simulating an ovarian cyst. *Am. Jour. Obst. and Gynec.*, 25: 440 (Mar.) 1933.

HYPERTENSION, OBESITY, VIRILISM AND HIRSUTISM ASSOCIATED WITH ADRENAL CORTICAL CARCINOMA

RICHARD JOSEPH WHITE, M.D.

FORT WORTH, TEXAS

THE gradual realization of the profound influence on metabolism, sex characteristics and in some instances blood pressure which certain tumors of the adrenal cortex exert has been one of the most interesting chapters in the study of the glands of internal secretion. That these changes have always interested medical men is borne out by Arthur Collett's statement that Hippocrates described 2 cases of virilism in married women whose bodies resembled the male and were covered with hair, they each had a beard and their voices were deep. He says that William Cook in 1756 was the first to give a more exact description of a case in connection with a suprarenal tumor in a seven year old girl. She was enormously fat with a thick growth of hair on the face and genital organs. Bevern and Romkild in 1802 described a three and a half year old girl who looked like a woman of twenty with a thick growth of hair on the genitals and face. In describing a similar case Bullock and Sequeira were the first to point out that the adrenal cortex is the site of a new growth. There are recorded instances of extreme pseudohermaphroditism in infancy due to these tumors developing in fetal life. In young children they occur much more frequently in girls. The victims grow fat with the fat confined to the trunk, neck and face, the clitoris may become huge, hair grows on the face and body, the voice becomes coarse and deep and thickening of the vocal cords has been observed laryngoscopically. If they live until the normal time for the catamenia they usually do not menstruate. Cecil cites exceptions to this, however. Hypertension has been recorded even in very young children. In young boys the virile tendency is striking. A beard, a deep voice, mustache, profuse pubic hair, a man sized penis and sometimes the most astonishing muscular strength are seen. Geschichter cites a case of Park's with bilateral adrenal cortical hyperplasia whose strength was such that at two years he could over power children seven and eight years of age. At four his penis measured four inches, he had a mustache, his weight was seven kilograms above the predicted value and the epiphyseal development of his bones that usually seen at puberty. A few of these children with a slowly growing tumor have become prematurely senile and died young. True pubertas praecox in the sense of potentia or spermatogenesis is evidently very rare.

In adults these tumors have occurred preponderantly in women and their most conspicious effect has been in as far as it is possible in the mature state to make a man out of a woman. Growth of facial and body hair has been marked. The male escutcheon has appeared on the abdomen, the voice has deepened and roughened, menstruation has become scanty or ceased, a masculine case of features has appeared, an aversion to intercourse or in a few instances a reversal of sex interest has appeared and in some cases a loss of normal feminine modesty. A considerable number of adult women have had a very pronounced hypertrophy of the clitoris. In many cases the appetite has increased enormously and there has been a large gain in weight with distribution of fat to the trunk, face and neck, sparing the extremities. There has often been hypertension which is somewhat variable, and dyspnoea and edema have been frequent complaints and hypertrophy of the heart has been demonstrated. The hypertension is not of

the classical paroxysmal type which, in the cases of Rowntree and C. H. Mayo, Shipley and Pincoffs and the Porters, has

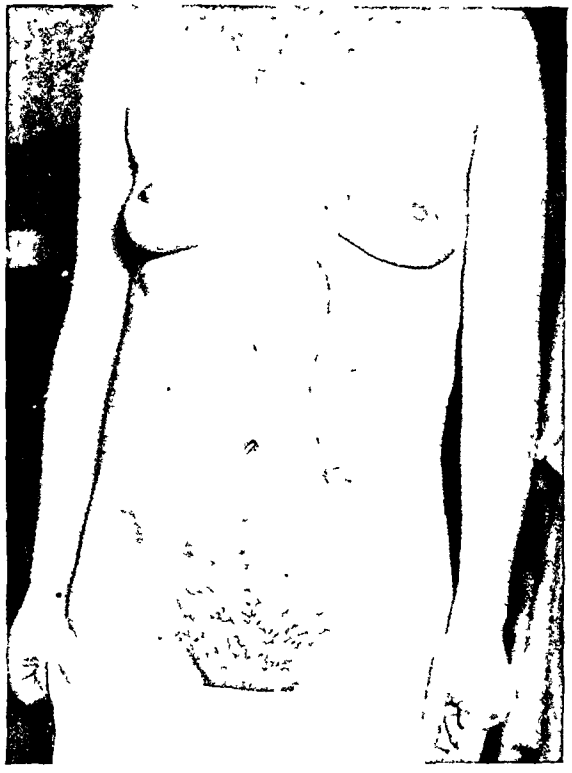


FIG. 1. Distribution of eruption on upper part of body. Hair growth not well shown as patient refused photograph to be taken until after operation.

been proved by operative removal giving relief, to be due to a paraganglioma arising from the adrenal medulla, but must be related in some way to the metabolism of adrenalin. These tumors are rare in men but are said to produce a pronounced virilism; however, several cases of the opposite experience are quoted, notably that of Bitdorf-Mathias in which a man twenty-six years of age had shortness of breath for eight months, enlargement of breasts for one year and a few months later the testes began to atrophy. Six months later he became impotent and in eight months a tumor of the left part of the abdomen was observed. Soon widespread metastasis was apparent. Autposy showed hypernephroma of suprarenal cortex. Both breasts showed glandular tissue. The interstitial cells in the testes were hardly developed. Geschichter quoting Holl cites another remarkable instance of a man forty-four years old who had enlargement of the breasts and pigmentation of the



FIG. 2. Acneiform eruption, coarse features and hair growth on the face. Patient had tweezed many hairs out of face.

nipples. The testicles and penis decreased in size and sexual feelings were lost. He gained in weight and the masculine expression of the face was lost. A tumor over the left kidney was removed followed by a return of male characteristics.

Three explanations of the sexual changes observed in adrenal cortical tumors have been offered. (1) The adrenal cells of the tumor act indirectly on the gonads. (2) The adrenal cells retain their primitive sex functions and produce these changes. (3) The adrenal cells stimulate the cells of the anterior pituitary which in turn act on the gonads. This is a most intriguing theory in view of the marked similarity clinically between the effects of the basophilic adenomata of the pituitary and cortical tumors, but in Frank's case with a typical Cushing syndrome characterized by obesity of the face and trunk, hirsutism, so called pig eyes, persistently high blood pressure with attacks of hypertension, amenorrhea and menstrual irregularity, pinkish skin stria, rarefaction in bones,

polycythemia, cyanosis of extremities and susceptibility to infection; in short every diagnostic point necessary to establish Cushing's disease, at autopsy a large adrenal cortical carcinoma was found but no trace of a pituitary adenoma. Robert Frank studied another very similar case finally proved at autopsy to be an adrenal cortical carcinoma and found that in both instances the clinical picture was that of a basophilic adenoma of the pituitary. Hormone tests for four weeks showed negative pregnancy tests and no increase in prepituitary and female sex hormone circulating in the blood. On the other hand, the excretion of female sex hormone in the urine was at times tremendously increased to a degree seen normally only in pregnancy (13,000 mouse units per litre). He since has tested several cases thought to be true examples of basophilic adenoma of the pituitary and the female sex hormone was not increased. He thinks this might serve to differentiate the two conditions in an early and operable state.

An acneiform eruption has been a conspicuous feature of many of the cases described. The skin often is coarse and oily and the eruption is usually confined largely to the face and chest. There are several cases described of diabetes associated with hirsutism and a cortical tumor, the "Diabete des femmes barbes" of the French. The case of Achard-Theirs was a woman seventy-one with masculine facies, large mustache and beard, heavy eyebrows and the blood pressure was 220/100. She lost several grams of sugar daily in her urine but diet controlled this. At autopsy both suprarenals were enlarged and showed marked hyperplasia. Keyser and Walters describe a case with an adrenal cortical carcinoma associated with a thyroid disturbance and diabetes. Doubtless the pituitary plays some role in the cases associated with diabetes.

TREATMENT

In most instances the tumors which produce these changes are malignant and extensive and for practical purposes inoperable but as Lesser says almost any reasonable risk is justified if there is a chance of relieving these poor people. The remarkable and often quoted case of Gordon Holmes is an illustration of what may be occasionally accomplished. A girl, formerly very attractive physically, developed a heavy beard and general hypertrichosis due to the slow growth of a tumor starting in the cortex of the right suprarenal. Her features changed to resemble the male. Menstruation ceased, her clitoris hypertrophied and she lost all interest in the opposite sex and preferred the society of women. The right suprarenal was removed and all signs of virilism disappeared. Regular menstruation reappeared, the clitoris returned to normal size, abnormal hair fell out, her breasts developed and in general femininity reappeared. Nine years later she was still a perfectly normal woman. In patients with the large cortical tumors that have been operated they not infrequently have survived the immediate effects of the operation but have died in twenty-four to seventy-two hours with low blood pressure, fast pulse and loss of consciousness and at autopsy the other suprarenal has been found atrophic. Walters thinks he has tided a patient or two over by injections of eschatin postoperatively. This atrophic state of the opposite adrenal fortunately has not been found in the medullary tumors causing paroxysmal hypertension.

PATHOLOGIC ANATOMY

The adrenal is a compound gland. Its central or medullary portion belongs to the chromafil system so-called from its characteristic staining together with the paraganglia of the sympathetic nervous system, the carotid and aortic bodies, to any tint between yellow and dark brown in the presence of chromium salts. The function of these cells is to secrete adrenalin and they are not necessary to life. The cortex of the gland originates from the Wolffian body and its secretion is necessary to life. Ewing states that the tendency of many of

these tumors to reveal mesoblastic or sarcomatous origin has recalled occasionally their mesothelial origin but the acquired epithelial character of the cells predominates in most of the growths, which behave as adenomata or carcinomata. Diffuse hyperplasia, adenomata or carcinomata all occur. The carcinomata are soft, yellowish and prone to necrosis and hemorrhage. Central softening may yield cysts of large size. Early and widespread metastases are a prominent characteristic of adrenal cortical carcinoma.

CASE REPORT

Mrs. J. T. H., age thirty-seven, had been normal all her life until the onset of her present illness, menstruated regularly and had a healthy child, thirteen years old. Her first complaint occurred eight months before I saw her and consisted of a sharp attack of pain in her left upper abdomen which lasted three days and required morphin for relief. She had been of a quiet temperament but was extremely nervous and had headaches and weakness for some time following this. Her upper abdomen was quite tender. Her physician told her she was threatened with a "nervous breakdown." After three months she noticed short episodes of breathlessness and that her period was delayed and scanty and that hair in large quantities was beginning to grow on her body, face and extremities. Shortly after this a lump was discovered in her left upper abdomen and thought to be the spleen. A pyelogram demonstrated a normal pelvis in the left kidney with the kidney displaced downward and its upper pole rotated somewhat inward. Her doctor stated that she was carrying a marked hypertension at this time, his letter three weeks before I saw her stating his last record was 164/110. She had been in Fort Worth more than two weeks when I saw her with Dr. C. P. Higgins. Her lump had grown rapidly. Cystoscopic examination had been repeated and the kidney displacement was more marked. For several weeks she had had a most annoying skin eruption diagnosed by a dermatologist as a drug rash attributed to amytal of which she had been taking large quantities. She had gained fifteen pounds in weight and said she had a ravenous appetite. She had had several chills followed by high temperature for a few hours, and the negative cystoscopic urinary findings together with the lump previously diagnosed as spleen, had led to an energetic but vain search for malaria. Her voice was coarse, deep and husky and she said this change had been progressive almost from the onset of her symptoms. She had only two very scant menstrual periods in the last eight months. She stated that the caresses of her husband were repulsive to her but that she was not especially averse to intercourse. On examination her bloated, obese appearance, the papulo-pustular eruption involving her entire body from the hips upward, most marked on her face and anterior chest, the profuse growth of hair over her body with male distribution on the abdomen and the coarse voice made a very striking picture. There was a large, firm, slightly tender tumor, the size of a fetal head at term protruding beneath the left rib margins and extending past the midline and down to the level of the umbilicus. Pelvic examination showed a small, freely movable uterus. The tubes and ovaries could not be felt. The clitoris was distinctly though not hugely hypertrophic. The blood pressure was variable but did not reach over 155/100 at any time it was recorded.

Her blood count showed 4,080,000 red cells and hemoglobin 70 per cent. The leucocytes were normal. Her blood Wasserman was negative. The blood sugar was 100 mg. per 100 c.c. Her urine showed a trace of albumin and a few granular casts.

It was apparent that the tumor was not spleen but originated almost certainly from the adrenal cortex. Upon abdominal exploration there was found a huge semifluctuant retroperitoneal tumor across which the body and tail of the pancreas were stretched. It was clearly inoperable. A trocar and cannula were inserted and some bloody fluid and a mass of yellowish tumor cells large enough for a microscopic examination were secured. The bleeding was controlled with two stitches. The spleen was atrophic and the kidney displaced downward and mesially. The abdomen was closed in layers.

Pathological Report: The biopsy removed from this tumor at the time of exploratory operation consisted of a very small, hemorrhagic, friable, pinkish brown piece of tissue. Microscopically the sections showed a small amount of fine vascular stroma, large areas of necrosis with hemorrhage and sheets of tumor

cells. The tumor cells varied greatly in size and shape, the majority of the nuclei being hyperchromatic and contained many mitotic figures in the different phases of development. There was no evidence of attempts to reproduce the zona glomerulosa or the columns of the zona fasciculata. The cellular arrangement was much wilder and no adrenal structures could be recognized. In some areas the tumor cells showed a decided perivascular arrangement, frequently found in the more active, anaplastic, malignant, adrenal carcinomata. The pseudopapillary type of cell arrangement that has been described as occurring in some cases of highly malignant adrenal tumors, due to the softening of the central lines of tumor cells, was not observed in sections from this tumor.

The numerous chills which she had were no doubt due to the necrosis in the central portion of this massive tumor growth.

Her subsequent course was rapidly downward. When she left for her home in West Texas six weeks postoperatively she was complaining of increasing paroxysmal breathlessness. Three months later her home physician wrote that she had extreme edema of the legs, slight jaundice, severe dyspnoea and a marked increase of hair growth on her face. Shortly after this she died. A more dramatic example of the perversion of endocrine function could hardly be imagined.

SUMMARY

A case is presented showing all the outstanding features commonly associated with an adrenal cortical tumor, namely hypertension, obesity, virilism, hirsutism, coarse voice and acneiform eruption. The diagnosis is confirmed by histological examination of a piece of tissue excised from the tumor. A brief review of the literature of this rare condition is submitted.

REFERENCES

1. Ewing, James. Neoplastic Diseases, 2nd Edition W. B. Saunders Co., Phila. 1922, pp. 755–762.
2. Collett, Arthur. *Am. J. Dis. Children*, 27: 204–218 (March) 1924.
3. Meyer, Jacob and Frumers, Gerald. Tumors of the suprarenal gland with especial reference to carcinoma of the cortex. *Arch. Int. Med.*, 48: 611–626 (Oct.) 1931.
4. Frank, Robert T. *Proc. Soc. Exper. Biol. and Med.*, 31: 1204–1206, 1934.
5. Barker, L. F. An extraordinary genito-suprarenal syndrone (adult form of hyperenterrenopathy with virilism and hirsutism) due to malignant tumor originating in the cortex of the right suprarenal gland. Autopsy findings. *M. Clin. N. Am.*, 14: 269–279, 1930.
6. Keyser, L. D. and Walters, W. Carcinoma of the suprarenal associated with unusual endocrine manifestations. *J. A. M. A.*, 82: 87–88, 1924.
7. Duncan, G. G. and Fetter, F. Suprarenal tumor, hirsutism, diabetes. *M. C. N. Am.*, 261–268 (July) 1934.
8. Cecil, Howard L. Hypertension, obesity, virilism and pseudohermaphroditism as caused by suprarenal tumors. *J. A. M. A.*, 100: 7, 463–66, 1933.
9. Gesckichter, Charles F. *Am. J. Cancer*, 23: 1, 104–124, 1935.
10. Rowntree, Leonard G. and Ball, Ralph G. *Endocrinology*, 17: 263–294, 1933.

ABNORMALITIES OF ROTATION OF MIDGUT

H. H. DONALDSON, M.D., F.A.C.S

Mercy Hospital

PITTSBURGH

THE management of the occasional case showing unfamiliar pathology presents one of the greatest difficulties to the surgeon often due to inexperience in treating such lesions and especially to lack of knowledge of the cause of the disease. An experience with a case of rotation of the midgut made us conscious of our shortcoming concerning the cause and results of such abnormalities. We will not go into the details of the embryology of the intestinal tract but will try to emphasize how important is the matter of the rotation of the midgut. Our comments are based on published papers and on a limited experience.

Some important preliminary statements are in order. The foregut ends at a point in the duodenum just proximal to the bile and pancreatic ducts. The function of this portion is largely digestive and its blood supply is from the celiac axis. The midgut begins at the lower limit of the foregut and extends to a point just beyond the middle of the transverse colon. The absorptive function is largely in this portion and its blood supply is from the superior mesenteric artery. The remainder of the tract is composed of the hindgut and its function is largely excretory, its blood supply being from the inferior mesenteric artery.

The fact of rotation had long been recognized but it was not until 1915 that an attempt was made by Fraser and Robbins to explain its cause. The foregut and the hindgut are not concerned in the problems of rotation.

At about the fifth week, elongation of the midgut and the rapid increase in the size of the liver causes insufficient space in the abdomen and results in the midgut protruding into the umbilical cord producing a physiological umbilical hernia, or the first stage of rotation of the midgut. Rarely, a portion of the intestinal tract remains in the umbilical cord and its persistance until the time of birth presents the condition known as congenital umbilical hernia. Such congenital hernia may contain all or a portion of the midgut. In one case operated by Buchanan in 1908 even the liver was present. Only those cases of congenital umbilical hernia containing a portion of the midgut can be operated successfully; otherwise, there is not enough room in the abdomen to contain it. Figure 1 represents the alimentary tract at the eighth week of intrauterine life and shows the divisions into foregut, midgut and hindgut, and the completed first stage of rotation.

Since Fraser and Robbins' article apparently all writers on this subject agree as to the cause of the first stage of rotation. Excellent articles on abnormalities of rotation have been written by Dott, Gardner and Hart, and Haymond and Dragstedt and others.

The second stage of rotation includes returning the intestine from the umbilical cord to the abdomen and this occurs about the tenth week. Figure 2 represents the position at the end of the second stage of rotation.

It is difficult to explain the cause of the return to the abdomen. No traction of any kind has been discovered. Fraser and Robbins believe the return is due to suction because of the fact that the liver in this stage grows slower than the abdominal cavity, causing a fall in the intraabdominal pressure. At the same time, due to the total growth of the fetus, external pressure is exerted on the umbilical cord which also favors the return of its contents to the abdomen.

During this stage of growth a prearterial segment and a postarterial segment are described, as shown in Figure 2, the former

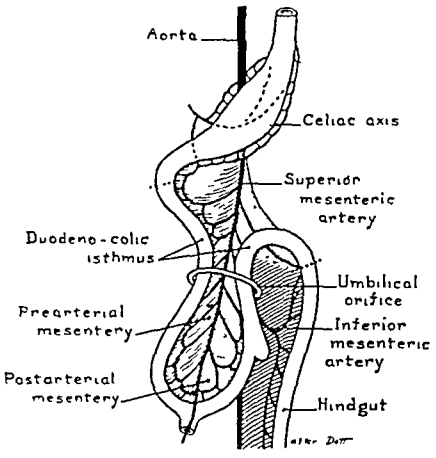


Fig. 1.

being the right half and the latter the left half. While the midgut remains in the abdomen, the prearterial segment grows more rapidly than the postarterial segment, so that the former becomes disproportionately elongated. In 2 cases reported, one by Haymond and Dragstedt and another by Lickley and Cameron, this disproportionate growth was deemed excessive and to have caused rotation into the prearterial mesentery of the postarterial segment. In their cases this persisted until adult life and in Lickley and Cameron's case death was not associated with this condition. Such a condition resembles an internal hernia, all of the small intestine being in a sac and is not exposed to view when the abdomen is opened. The above condition was found at operation by Griffith and his case corresponded almost in detail with the representation in Figure 5.

When the second stage of rotation takes place normally, the small intestine returns first, apparently because the cecum is more bulky, the result being the relative position of the colon and the small intestine found in the normal individual, the colon lying anterior to the duodenum and superior mesenteric artery. The superior mesenteric artery is the axis of rotation in this stage. If for any reason the primary return of the small intestine is impeded, as in Hunter's case in which a mesenteric cyst was attached to the jejunum, then the

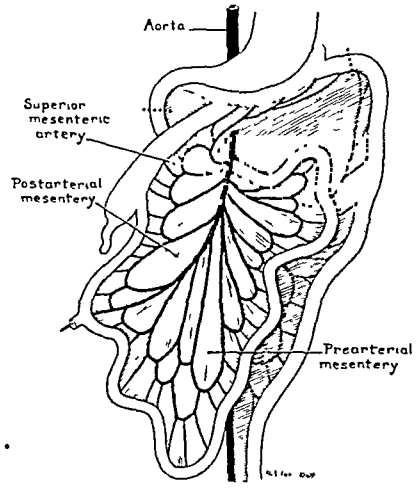


Fig. 2.

cecum may return first and the completion of rotation will be in the reversed direction and the colon will pass posterior to the duodenum and superior mesenteric artery. Such condition is known as reversed rota-

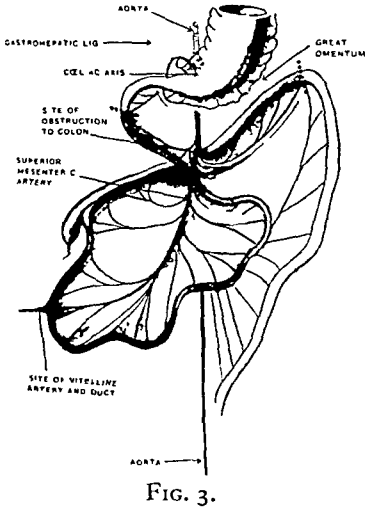


Fig. 3.

tion; therefore, the sequence of the return of the loops of the midgut determines whether rotation will be normal or reversed. Figure 3 represents reversed rotation which results in the transverse colon being located behind the duodenum and the superior mesenteric artery.

The third stage of rotation is less important and is not completed until about the time of birth. It results in the individual

loops finding their final location. The cecum rotates first into the right upper abdomen and later descends to its perma-

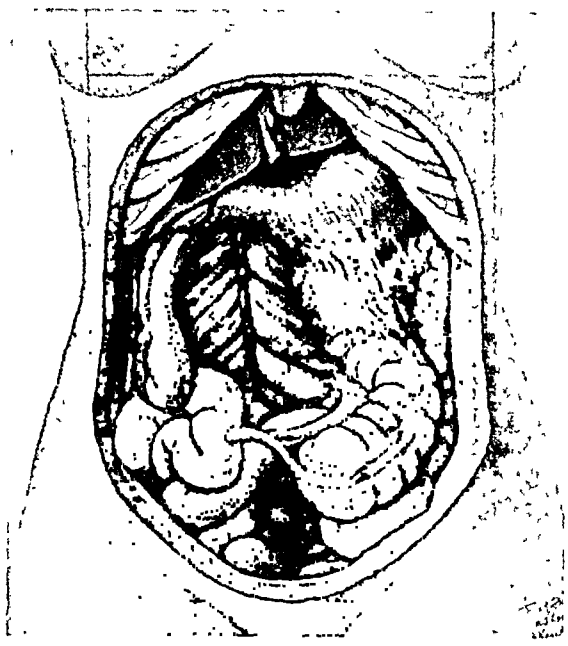


Fig. 4.

nent site. Imperfections in this stage may result in the cecum being near the midline immediately under the liver or partially descended. Deficiencies of fixation in this stage may result in portions of the tract being insufficiently fastened. Variations in the permanent location of portions of the midgut often lead to difficulties of diagnosis, but the mere abnormal position does not produce, as a rule, any complications. However, as a result of the abnormal positions or fixations, adhesions may form causing obstruction or a volvulus may occur as the result of insufficient fixation.

Of all the reported cases of abnormalities of rotation, the lesion most often encountered is a volvulus of the midgut loop. Its etiology requires little explanation. There is a narrow neck of attachment as shown by Figure 2. Last year Gardner and Hart cited 86 cases of such lesion from the literature. They added 2 cases which recovered after detortion of the midgut. The age in this series varied from newborn infants to the age of fifty-five years, less than one-half occurring in the first decade of life; 29 were newborn infants. In this series of cases the mortality of the unoperated group was 100 per cent.

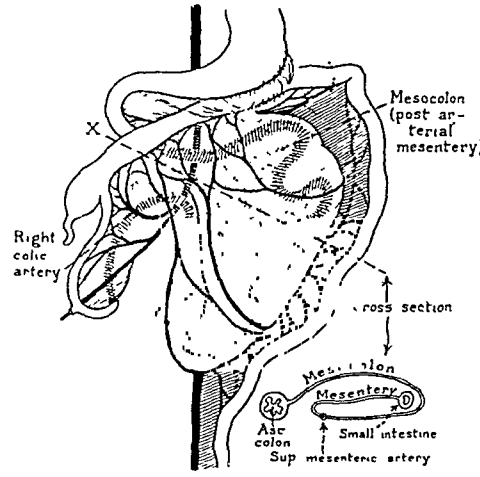


Fig. 5.

Fifty per cent of the operated cases recovered.

Another abnormality of rotation is that of non-rotation. This of itself may produce no symptoms, its importance consists chiefly in that the permanent position of the different loops of the intestines is abnormal. The entire colon occupies the left side of the abdomen, the ascending and descending colons being practically parallel and in contact, the small intestines lying in the right side of the abdomen and the ilium entering the cecum from the right. Such condition in the absence of acute pathology may be diagnosed by *x*-ray films. The appendix may be found near the midline or in the left side of the abdomen as a result of non-rotation or of an imperfect third stage of rotation. Non-rotation is shown in Figure 4.

Reversed rotation is rare. When Dott wrote very conclusively on this subject in 1927, he reported only 2 cases. Gardner and Hart last year reported 14 cases and we have found record of 4 other cases and report herewith a fifth case. The lesion found has usually been an obstruction of the colon where it passes through the mesentery of the small intestine. At operation this condition is recognized by the relationship of the duodenum and the

transverse colon, the entire duodenum being visible because it lies in front of the transverse colon. The hepatic flexure is said to be absent in most cases as it was in ours, the colon passing from the cecum directly upwards and to the left. In our case the small intestine was examined carefully from end to end and seemed to be very short. The superior mesenteric artery can be identified in its abnormal position in front of the colon.



Fig. 6.



Fig. 7.

CASE REPORT

Our patient was a girl, eight years of age, whose past medical history was unimportant, giving no hint of any abdominal abnormality. Her illness began three days before our examination with moderately severe epigastric pain and vomiting. During the first two days the bowels were moved by enemas. There was no abdominal distension at any time. The child did not appear to be extremely ill. Her pulse was 110 and her temperature was 99.4°F. She had vomited about four hours before the examination.

Examination showed a flat abdomen with moderate prominence in the left upper abdomen which was thought to indicate a distended stomach and a collapsed intestinal tract. There was some tenderness under the upper portion of the right rectus muscle, but no palpable mass. Peristalsis was active but not excessive. An obstruction of the pylorus or duodenum was diagnosed and the abdomen was opened immediately through a high right rectus incision. The entire intestinal tract was collapsed. The stomach was greatly distended and seemed to extend under the left leaf of the diaphragm for an abnormal distance. Detailed examination of the small intestine beginning at the cecum proved that the duodenum lay in front of the transverse colon. The cecum lay in the right lower abdomen and the colon extended diagonally upwards and to the left and disappeared under the distended stomach. There was a suggestion of the normal horseshoe shape of the duodenum, but the proximal portion extended deep in the epigastrum apparently to the point of obstruction. The stomach was explored and, when drawn into the wound, showed a normal spleen attached closely to the body of the stomach.

On account of so many abnormalities particularly of the position of the colon and inability to visualize the obstruction, an anterior anastomosis was done selecting the movable upper portion of the intestine.

The patient made an uneventful recovery and has been in good health since attending school regularly. She has, however, had several attacks of nausea and vomiting but these have never been associated with pain. The operation was done one and a half years ago. A recent *x*-ray study of the gastrointestinal tract showed interesting results, illustrated in Figures 6 and 7, revealing the absence of both splenic

and hepatic flexures of the colon, an eventration of the left leaf of the diaphragm showing that the colon and stomach extend to a point about three inches higher than the dome of the liver on the right side, and a displacement of the heart to the right for a distance of about three inches. Dullness and absent breath sounds at the base of the left chest on physical examination verifies the *x*-ray finding.

This is the most interesting case that we have had demonstrating abnormality of rotation and the only one showing serious disturbance of function and threatening the life of the patient. In the course of routine abdominal surgery other abnormalities of rotation have been encountered.

The following points seem important:

1. Abnormalities of rotation may result in misplacement of viscera and confusion in diagnosis.
2. Such lesions are encountered in young patients but are by no means confined to this age group.
3. As a result of misplacement with too great mobility or too much fixation, serious obstruction may occur.

SUMMARY

The object of this communication is to call attention to the practical importance of a knowledge of abnormalities of the midgut. The causes and the results are discussed. A case of reversed rotation is reported.

HEMORRHAGIC INFARCTION OF CECUM

PROBABLY CAUSED BY ACUTE GONORRHEAL INFECTION

I. B. HARRIS, M.D., F.A.C.S., FRANK E. HAMILTON, M.D. AND GEORGE E. PETERS, M.D.

Professor of Clinical Surgery, Ohio State University, College of Medicine; Chief of Staff, St. Francis Hospital; Visiting Surgeon, Grant and Starling-Loving Hospitals

Department of Clinical Surgery, Ohio State University, College of Medicine

COLUMBUS, OHIO

A REVIEW of the literature reveals that primary infarction of the large intestine is very rare. Reports on infarction of the vessels of the large intestine alone are confined, to date, to two cases. Mesenteric thrombosis is relatively common, as seen with embolic plugging of branches of the superior mesenteric vessels going to the small intestine, or the main trunk of the superior mesenteric artery, with the production of infarction of the small intestine and the right side of the colon. In addition there are about 70 reported cases of mesenterial pyemia with the production in the late stages of infarction of a considerable portion of neighboring intestine; Petren estimated that this complication is found in 5 per cent of all autopsies following death from appendicitis. But primary non-suppurative infarction of the colon alone, or portions of the colon, is quite rare; a careful search of the Surgeon-General's library for the past twenty-five years disclosed the literature on embolism and thrombosis of the mesenteric vessels to be covered quite extensively by Reich in Ergebnisse die Chirurgie und Orthopädie, in 1913 in which he reported 18 cases of infarction of the small intestine, successfully treated by operation, and not a single one of infarction of the colon. A little later, however, Bruns reported a case of hemorrhagic infarction of the cecum and ascending colon, with involvement of the appendix; and in 1929 Pendl[5] reported a case of hemorrhagic infarction of the cecum only, with no involvement of the appendix; since that time, no further cases have been reported.

The case that we are now reporting is one of primary, non-suppurative infarction of the cecum with no involvement of the appendix. In its pathological physiology it seems comparable to Pendl's case and has many points of similarity with Bruns' case, yet, as will be seen in the following analytical discussions, the history of our case shows that it is unique in surgical literature.

CASE REPORT

The patient a white, American male, age thirty-three years, was admitted to the hospital 11 A.M., November 13th, 1934 complaining of pain in the right lower quadrant. He was operated at 1:25 P.M. on the same day.

Present Illness. The patient had no complaints and no abdominal pains until November 12th, 1934 when immediately postpraudially, he noticed a slight pain all over the lower abdomen; there was no associated nausea, and within a short time the pain had disappeared. The patient continued to drive on his rounds as an insurance adjustor feeling quite comfortable; however, after his evening meal the same pain appeared in the same location with a little greater severity; but as before the pain soon disappeared. On arriving home and being hungry, he ate some sandwiches and soon had sharp pains over the lower abdomen. These rapidly became worse and were of sufficient severity as to interfere with his sleep that night. During this time there was no nausea or vomiting, but there was a constant desire for defecation, yet in spite of numerous attempts there was no bowel movement. Later he thought that although he was not nauseated perhaps

he might feel better if he vomited, so several times he gagged himself by putting his finger down his throat with no results. However, by morning he had excruciating cramping pains in the lower umbilical region; he was slightly nauseated, ate no breakfast, and vomited a small amount once. His doctor saw him 11 A.M. November 13.

Past Medical History. Previous to his present illness the patient has had no trouble with his bowels, either constipation or diarrhea; he has had daily bowel movements without recourse to laxatives. He never had a tarry stool. Nor has he ever noticed blood of any type in his stool; in his childhood he had frequently passed small amounts of mucous in his stools but this has apparently been symptomless and he gives no history of colitis. Occasionally he has passed a dark colored stool, but he states this always occurred after he had blackberry wine.

Occasionally the patient would indulge in excessive smoking for several days at a time, following which he would be aware of some acidosis, eructation of gas, slight indigestion and a cough, but these symptoms were never noticed except after excessive smoking.

He developed a gonorrheal discharge in 1928, which he thought had been cured; but after an additional recent exposure, the gonorrheal discharge reappeared November 9th, 1934. This infection was under treatment at the time of operation, became more profuse just following operation, but was quickly amenable to treatment after he left the hospital and has now disappeared.

He had influenza in 1921; a tonsillectomy and adenoidectomy in childhood; no other serious illness or operations.

His family history was essentially negative.

Social History. Patient is an insurance adjustor; driving his own car an average of about 2000 miles per month. On the day he became sick, November 12, 1934 he had driven 218 miles.

Physical Examination. Reveals a well developed, well nourished young white male. The abdomen was diffusely tender, most marked on palpation in the right lower quadrant with very slight rigidity. No masses were palpable in the abdomen. The genitalia showed a yellow urethral discharge which on smear was positive for gonococci.

All his extremities were normal.

Laboratory Examination. November 13, 1934. Blood count showed erythrocytes 5,120,000, leucocytes 21,600 with granulocytes 92 per cent, lymphocytes 6 per cent and monocytes 2 per cent.

The urine was clear amber, specific gravity of 1.022, acid reaction; negative for albumin and sugar; microscopically showing many red blood cells, a few white blood cells and an occasional epithelial cell.

The urethral smear, on November 23, 1934, with the Loeffler and Gram stains showed gram negative, intracellular diplococci.

Operation. November 13, 1934. The preoperative diagnosis was acute appendicitis. On opening the abdomen a considerable quantity of serosanguinous fluid escaped from the peritoneal cavity. The cecum was found to be very much thickened, greatest in the outer and anterior surface and very dark in color. The discoloration, to a greater or lesser degree, involved practically the entire cecum, most intense in its anterior wall. The smaller blood vessels were seen to be full of blood clots. The appendix appeared perfectly normal and no other pathology was evidenced within the abdominal cavity.

Under ether anesthesia an incision was made to the right of the right rectus muscle. The lower right quadrant of the abdomen was carefully explored. The appendix was removed by first ligating the meso-appendix, cutting and tying the appendix off at its base, carefully carbolizing, but not inverting it. Then the cecum was dropped back into the peritoneal cavity and a cigarette drain was carried down to the surface of the cecum, and drawn out through the lower angle of the wound. The omentum was then placed carefully over the cecum to attempt establishing a communication between the blood vessels of the cecum and the vessels of the omentum. Then the abdomen was closed with drainage in the usual manner.

The patient was returned to his bed and for forty-eight hours an ice cap was placed over the incision. Enough morphine to control the pain and a hypodermoclysis of normal saline and glucose with nothing by mouth for twenty-four hours.

One cigarette drain was kept in the lower angle of the wound for four days.

Progress. The day following the operation the temperature reached its highest point of 101.8°F.; the pulse was 120 and respirations, 24. On the fourth postoperative day the temperature dropped to normal.

The patient was given an enema on the fourth day following operation. The next day he had a normal bowel movement but with considerable pain around the rectum and a small stain of bright red blood was noticed; examination revealed a fissure of the anus, with the bleeding apparently from that source. This slight bleeding occurred twice more while in the hospital, and once after returning home, each time after a difficult bowel movement. Treatment for the gonorrheal urethritis was started November 27, 1934. The progress was otherwise uneventful and the patient was discharged on December 3, 1934.

Follow-up. After discharge from the hospital the patient reported four times to the office merely to state that he was doing well. Examination January 29, 1935 showed the incision to be well healed, no hernia and no tenderness on deep pressure anywhere in the abdomen. Patient states he has no complaint and has a good appetite; for a while after leaving the hospital he noticed slight indigestion after each meal but is not noticeable now.

His normal weight is 155 pounds. He lost ten pounds while in the hospital; seven weeks after discharge he weighed 152. He returned to work December 18th, and is working full time at the same job he had before hospitalization. Since returning home he has had daily bowel movements, without the use of laxatives; he has no pain of any kind and no blood in the passage.

DISCUSSION

Before drawing comparisons the mechanism of such infarctions is considered first. To quote from Pendl,

> On the basis of numerous observations in cadavers and experiments in animals (Kohnheim, Ziffer, Niederstein, Bolognesi, Merkel) we know that embolic and thrombic occlusion of the superior mesenteric artery induces complete cutting off of arterial blood supply from the region supplied by this artery, (small intestine and ascending colon) and that, in these regions, a more or less extensive hemorrhagic infarction (necrosis, and recurrent venous and arterial infiltration with blood) takes place. According to this, the superior mesenteric artery must be looked upon as an end artery, if not in an anatomic sense, at least in a functional one. Not only occlusion of the chief trunk but even a canalization disturbance in the medium sized and smaller arterial branches (Meier, Bolognesi) induces very severe nutritional disturbances in the intestinal wall. Such disturbances have been histologically analyzed by Pommer (Virch. Arch. cc). Death usually occurs under symptoms of grave peritonitis or ileus, combined eventually with colic and discharge of bloody stool (not always).
>
> Cases in which there are said to have been no injurious results to the intestinal wall from such thrombosis of branches of the superior mesenteric artery must be evaluated most sceptically. A few exceptional cases do not change the anatomically determined fact that embolic and thrombic occlusion of the superior mesenteric artery or its branches usually has a fatal course. There are more than 150 cases of this sort reported in the literature. Attention should also be called to the fact that the intestinal wall will suffer the same injurious results in connection with primary thrombosis with occlusion of the mesenteric veins. A number of cases of this kind have also been reported to date. We should bear in mind however, that this thrombic occlusion of the mesenterial veins may also, in many cases, be the result of small arterial embolisms, in the mesenterial region (Merkel).

It should be noted that in this case apparently the location of the primary embolism was in the ileocecal artery but due to the large amount of hemorrhagic infiltration it is apparent that the corresponding veins were also involved.

In this connection it is well to refer to the investigations of Pommer, mentioned above. In a case of primary arterial occlusion of the superior mesenteric artery Pommer determined numerous phlebitic changes, similar to those described in Pendl's case. The phlebitic changes in his case therefor, do not prove that the affection occurred by the way of primary venous occlusion. There seems on the contrary, to be some reason for supposing that the hemorrhagic infarction of the segment of intestine was caused by primary occlusion of the ileo-colic artery. This assumption is based upon the sudden genesis of the affection in the right side of the abdomen and upon the distinct limitation of the changes to the cecum and ascending

colon with *exclusion of the ileum and appendix.* According to Fischer (Circulatory disturbances of the gastro-intestinal canal, Berlin, *Handb. d. Spez. Pathol. Anat. u. Histol.*, 1926), this can only be explained on the basis of the assumption that there were old adhesions of inflammatory character in the region of the appendix, thus affording a certain vascular supply to the appendix, in ways other than from the branches of the superior mesenteric artery. But this interpretation of Fischer's can hardly be accepted if we make a study of the distribution of the branches of the superior mesenteric artery.

According to Cunningham and Davis, Applied Anatomy, etc., such a study shows the terminal branches of the ileocolic artery to consist of (1) the colic, which supplies the first part of the ascending colon; (2) the ileal, supplying the terminal portion of the ileum; (3) the appendicular, supplying the appendix; and (4) the ileocecal, which splits immediately to form the anterior and posterior ileocecal branches, supplying the anterior and posterior walls of the cecum only.

Thus there are, anatomically speaking, three conditions from which thrombosis of the cecum can arise: (1) infarction of the superior mesenteric artery; (2) infarction of the ileocecal artery above the point of origin of the appendicular artery; (3) infarction of the ileocecal artery, below the point of origin of the appendicular artery.

So there is nothing to contradict the assumption that embolic or thrombic occlusion of the ileocecal artery, below the point of departure of the appendicular artery, may cause the changes in the cecum as have been described in this case, and that, as a matter of necessity, the appendix must be exempt from this infarction.

This assumption seems more reasonable to Pendl than an assumption of similar primary affection of the vein because he thinks that in the latter case the affection would be more diffuse in view of the more numerous anastomoses. In the left portions of the colon, approximately from the right third of the transverse colon to the rectum, grave hemorrhagic infarctions do not occur. This portion of the colon derives its blood supply from the inferior mesenteric artery which has generous anastomoses and functionally, does not behave like an end artery.

At this time it would be well to give a brief review of the 2 cases which have points of similarity with the one reported in this paper.

In 1929 Fritz Pendl reported a case of a man forty-one years of age who, unlike our case, had been suffering for six months from gastric disturbances accompanied by cramp like pains with constant twinging cramp like pains in the right lower quadrant when walking; on the morning of the operation, an egg shaped protrusion appeared in the region of the cecum, and a bloody stool was passed. Due to the painful tumor in the cecal region, the passage of a bloody stool on the preceeding night and the sudden occurrence of the last attack, a diagnosis was made of invagination of the ascending colon. No laboratory work was included in this report.

At operation:

> The cecum was found to be swollen to the thickness of a man's arm; it was hard like a tumor and highly edematous, and showed deep dark red and bluish discoloration. The upper ascending colon was discolored and edematous, but not hard and tumor-like; it was soft and compressible. The peritoneum was shiny throughout; the ileum and appendix seemed to be entirely normal. The surgeon proceeded with the resection of the cecum, ascending colon, and a part of the transverse colon. Opening of the cecum disclosed nodular formations similar to potatoes emanating from the posterior wall; they had the appearance of tumors and toward the outside they protruded beyond the serosa; the intestine was filled with bloody stool. The tumor like welts were found by histological examination to consist wholly of intestinal wall in a state of hemorrhagic infarction; there were no symptoms of inflammation aside from the perivascular cellular infiltrations. The appendix was obliterated,

otherwise it was histologically unchanged. Recovery was disturbed by an abscess of the abdominal wall, but otherwise it was smooth, so that the patient was able to leave the sanatorium completely recovered at the end of 25 days. The macroscopic and microscopic findings showed distinctly that this was a case of hemorrhagic infarction of a limited segment of the intestine, i.e., of the cecum only.

In 1913 Bruns reported a case in which the vascular occlusion seemed to have developed a little higher, immediately above the point of departure of the appendicular artery. There was an attack of pain in the right side of the abdomen about three weeks before the patient came for treatment. The patient was a boy, age eleven years; here likwise there was nothing to indicate the cause of the vascular occlusion.

The literature contains a few cases of post-infectious suppurative thrombosis of the appendiceal region of which the following 3 reports are interesting, showing the contrast between suppurative thrombosis and the non-inflammatory type reported in this paper.

Fromme reports a case of operation upon the ileocolic vein for an infected thrombus causing hepatic abscesses, apparently the purulent thrombophlebitis originating from distinct purulent changes found at operation in the appendiceal mesenterolium.

Held and Goldbloom report a case of acute diffuse ascending inflammatory thrombophlebitis of the mesenteric veins, apparently starting in the region of the appendix; the diffuse hemorrhagic infarction involving the cecum, including most of the jejunum, and extending into the liver; and another case of inflammatory invasion of the appendiceal mesentery as well as infectious thrombosis of the ileocolic vein, causing suppuration of the liver with the production of jaundice, the portal system not being involved. This condition of "thrombophlebitis mesaraica," or mesenteric vein pyemia, usually spreads through the mesenteric or portal system and is rapidly fatal. In this case also the infection started in the appendix and quickly involved the mesenterolium.

From these instances it will be seen that the suppurative post-infectious cases of infarction can be eliminated from consideration in our case; and that Bruns' and Pendl's cases are the only ones reported with comparable pathology. Both of these cases were non-suppurative infarctions of the terminal branches of the ileocolic artery, but Bruns' case can be ruled out of comparison with the case reported in this paper because the appendix was involved in the thrombotic process, while Pendl's case and our case apparently had the infarction develop at approximately the same place in the ileocecal artery, i.e., below the point of origin of the appendicular artery.

It is important to note, however, that concerning the 2 case histories, there are major points of difference between Pendl's case and ours. The points of difference that render our case unique in surgical literature are:

(1) In our case there was a total lack of any previous history of illness; (2) the symptoms, even the blood count, closely simulated acute appendicitis; (3) the rapid, uneventful and complete recovery of the patient without resection of bowel which, however, may have been partly due to the early diagnosis of an acute abdomen and the early operation.

As to a possible cause of a thrombosis in this unusual location Pendl states;

> As yet no one has succeeded in finding a cause for the embolic or thrombic occlusion of this branch of the ileo-colic artery. According to Fischer the source of the embolism is thrombo-endocarditis, a cardiac thrombus, or an atheromatous process of the aorta. Up to the present, arteriosclerosis of the vessels has been assumed to be the cause of thrombic occlusion of the upper mesenteric artery in practically every instance. Turk reports a case of compression thrombosis of the superior mesenteric artery, due to lymphogranulomatosis. In Pendl's case, however, no affection

of the heart, the vascular system, or the lymphatic glands could be determined or even seemed probable. (This same holds true in Bruns' case and in our case.) After recovery from the intestinal affection the patient was perfectly well.

A possible clue to the etiology in our case would be the acute gonorrheal infection with the urethral discharge appearing four days before admission to the hospital. Since we exhausted all other possibilities in seeking to determine the cause of this thrombosis, we appealed to the Director of Venereal diseases of the Surgeon-General's office for aid. His report, which covered all the literature of the past fifteen years, contained notations of 4 cases of thrombosis occurring in unexpected vessels during the course of an acute gonorrheal discharge; however, none of these thromboses occurred in any of the branches of the superior mesenteric artery, and the supposition was left that the thromboses were incidental in the course of a common infection.

In our case, however, we think it is quite possible that the acute gonorrheal infection was the cause of the embolism. It is known that gonococci attack serous membranes and produce such clinical manifestations as arthritis, endocarditis or even septicemia; therefore it is reasonable to assume that a gonococcal embolus might attack the endothelium of isolated vessels. There is little evidence with which to support this claim, save as stated, all other possibilities had been exhausted. On the other hand there is little evidence with which to disprove this claim. Therefore we feel without being able to come to a final conclusion concerning the etiology, that not only possibly but also probably, the patient's acute gonorrheal infection was the cause of the appearance of the embolism.

REFERENCES

Duvoir, M., Pollet, L., Layani, F., and Cachin, Marcel. A case of gonorrhea complicated by metastatic choroidoretinitis, severe meningomyelitis and endocarditis. *Bull. et mém. Soc. med. d. hôp. de Par.*, 49: 466, 1933.

Fessler, Alfred. A case of thrombophlebitis of the lower extremities in gonorrheal prostatitis. *Wien. med. Wchnschr.*, 82: 1552, 1932.

Fromme, Albert. Is it still possible to achieve operative recovery in late stages of purulent thrombophlebitis in the region of the ileocolic vein? *Zentrabl. f. Chir.*, 52: 450–454, 1925.

Held, I. W. and Goldbloom, Allen. Three rare intra-abdominal cases. *Surg. Clin. N. Amer.*, 14: 389–405, 1934.

Pendl, Fritz. Hemorrhagic infarction of the cecum. *Bruns' Beitr. z. klin. Chir.*, 145: 606–612, 1929.

Surgeon-General's Index of 1933.

SPONTANEOUS RUPTURE OF UTERUS*

REPORT OF A CASE

OSCAR H. BLOOM, M.D.

Associate Obstetrician and Adjunct Gynecologist, Beth-El Hospital

BROOKLYN, NEW YORK

A SURVEY of the literature of ruptured uterus impresses one with the inadequacy of the etiological classifications of the traumatic and the spontaneous varieties. Paradoxically, the etiology for spontaneous rupture is stated among other causes, as (1) scars from previous Cesarean section; (2) malpositions and malpresentations resulting in forceful and prolonged labors, and (3) contracted pelvis.

Obviously, rupture of the uterus may occur from such factors, but one cannot conceive why these ruptures are classified as spontaneous, since the uterus is traumatized, in these instances, as much as one may expect in external trauma, in the ill advised use of pituitrin, or intra-uterine instrumentations. It is my opinion that the term "spontaneous" be reserved for the uterine rupture, resulting from intrinsic myometrial pathology, existing, unknown and unascertainable, by the obstretician. All other etiological factors which tend to strain the uterine musculature, whether internal or external, should be classified as subheadings of the traumatic variety. For example, the literature is replete with statistics showing the relation of contracted pelvis to the so-called spontaneous rupture. Lobenstine[1] reports 21 cases in a series of 46, Trask 74 cases in 417, Ames, quoted by Davis[2] 15 cases in 100, and many others too numerous to mention. It is ambiguous and contradictory to leave the reader with the impression that a rupture of the uterus caused by contracted pelvis and therefore avoidable, is spontaneous and hence, to a great extent, unrecognizable and inevitable. In the same vein, rupture of the uterus resulting from malposition and malpresentation, which gives rise to prolonged and forceful labors, should not and cannot logically be considered as spontaneous, because the obstetrician can and should terminate such labors, before rupture takes place. Therefore, spontaneous rupture should be defined as a rupture caused by an inherent pathological state of the myometrium, undeterminable prior to the rupture. The following therefore, are the true causes for spontaneous rupture: (1) degenerative changes in the myometrium, such as hyaline degeneration, hydatitiform infiltration of the muscle, or thinning of part of the uterine wall; (2) congenital hypoplasia of the uterus, and (3) congenital anomalies of the uterus, as uterus duplex or uterus unicornis.

Spontaneous rupture of the uterus may occur during any period of gestation and during the first or second stage of labor. Baisch[3] in 1903, reported 78 cases of spontaneous rupture, 31 of which occurred in the first five months of pregnancy. However, this condition is found more often in the later months of pregnancy. Multiparity seems to be a predisposing cause and reports from different clinics give ratios of 8:1, to 41:1. Lobenstine[1] assigns several reasons for this; (1) the general health of the multipara is not as good as that of the primipara, and (2) the uterine musculature is weakened in the multipara by (*a*) previous inflammatory disease or (*b*) scars from former incomplete tears. Kane[4] states that hyaline degeneration of the uterine muscle and intra-uterine manipulations in previous

* From the Obstetrical Service, Beth-El Hospital.

labors may possibly explain the increased frequency in multipara. However, in his cases, infantilism was found in every case of rupture in primipara. Generally, the etiology for spontaneous rupture may be stated to be due, in primipara, to some congenital defect in the development of the uterus, or as in case report of Richardson,[6] due to excessive invasion of the uterine wall by the fetal elements. Baisch described cases of early rupture in which the muscle was described as "paper-thin," due to hypodevelopment.

Spontaneous rupture may occur without any apparent cause. Ivanoff (Lobenstine[1]) examined 19 uteri microscopically and found himself unable to explain the etiology on the basis of pathologic findings, although he did find some considerable variation in the percentage of elastic fibers to connective tissue. Kleinertz (Davis[2]) also cites a case of a para xi, who had eight spontaneous deliveries and two abortions. The uterus, removed after rupture, showed no pathologic changes. Pride[8] and MacPherson[9] also report similar cases, while Baisch in his series of 78 cases, reported 9 such cases. Bauereisen (Davis[2]) observed telangiectic changes in the lower uterine segment and confirmed the findings of Ivanoff, the variation of the percentage of elastic fibers to connective tissue in the vicinity of the rupture. However, Horn (Shugt[10]) in his studies, has concluded that diminution of the elastic fibers and accumulation of fat in the connective tissue toward the end of pregnancy, are physiologic phenomena and do not explain the cause of rupture.

Ruptures of the uterus may be divided into complete and incomplete. By an incomplete rupture is meant the laceration of the uterine wall to, but not including, the serous coat. Two varieties of incomplete rupture are described, rupture of the lateral wall into the broad ligament but not involving the peritoneum; and the so-called peritoneal fissure of Sanger, which may occur in either the anterior or posterior wall. Needless to say, these lacerations are seldomly recognized and are of interest insofar that they may serve as a point of least resistance in a subsequent pregnancy. Complete ruptures may be either transverse or longitudinal, spontaneous ruptures usually giving rise to the latter type. Lobenstine in his 46 cases, found 26 longitudinal and 20 transverse tears; of the vertical type, there were 18 on the left side, 6 on the right, and 2 medial; of the transverse, 13 were on the anterior wall and 7 on the posterior wall. Savage (Lobenstine[1]) in 36 cases, reports 21 vertical and 15 transverse. In the transverse variety, the frequency is greater on the anterior than on the posterior wall. Pure fundal rupture is rare.

CASE REPORT*

A. F. Aged thirty-three years, an Italian housewife, was admitted in shock, at full term. Her past medical and surgical history obtained from her husband were negative.

She was gravida vii, para vi; no abortions either induced or spontaneous. All previous deliveries were spontaneous—a midwife officiating. All puerperia were normal and uneventful. Patient at full term.

On the morning of admission to the hospital, the patient experienced several moderately intense contractions, which subsided to such an extent that she was able to go shopping, from which she returned to her home at 10:30 A.M., no trauma or undue strain occasioned during her period of shopping. Shortly thereafter the patient began to have a recurrence of her contractions and sent for her midwife, in preparation for delivery. Suddenly she experienced a severe pain in her left side and fainted, followed by a gush of blood and amniotic fluid per vaginum. The midwife recognized an emergency and called a physician, who sent the patient to the hospital with a diagnosis of placenta previa. On admission, the patient was in shock and almost pulseless, and in spite of all temporary measures to relieve her shock, preparatory to operation, she expired.

Palpation of the abdomen revealed the classical signs of rupture of the uterus, the

* From the Obstetrical Service of Abraham Koplowitz, M.D.

fetal parts were palpated under the abdominal wall, cessation of uterine contractions, absence of fetal movements and fetal heart sounds and no presenting part palpated per vaginum. Our diagnosis of rupture of the uterus was made, but treatment was not continued because of the death of the patient.

At autopsy the abdomen was filled with clots of blood and amniotic fluid, the fetus was lying free in the abdomen, the uterus was contracted and over to the left side of the pelvis.

The uterus was 7 inches long, by 4½ inches at the fundus, and about 3 inches thick. No gross pathology was found to explain the rupture. The laceration was on the anterior wall, in the midline, in the upper segment only.

Microscopic examination of the uterine wall showed marked hyaline degeneration of the musculature, not only near the site of rupture, but throughout the organ.

SUMMARY

1. The present terminology is confusing.
2. The term "spontaneous" should be applied only to those cases of rupture, in which the pathology is unknown and undeterminable prior to the rupture.
3. A new classification of the spontaneous variety of uterine rupture is suggested, based on intrinsic myometrial pathology.

REFERENCES

1. Lobenstine. *Am. Jour. Obst.*, 60: 819, 1909.
2. Davis. *Surg. Gynec. and Obst.* (July) 1913.
3. Baisch. *Beitr. z. Geburtsh. u. Gynäk.*, 7: 248, 1903.
4. Kane. *Am. Jour. Obst. and Gynec.*, 5: 158, 1923.
5. Goldstein. *Med. Jour. and Rec.*, 156, (Nov.) 1924.
6. Richardson. *Proc. Path. Soc. Phila.*, 22: 53, 1920.
7. Kleinertz. *Zentralbl. f. Gynäk.*, 40.
8. Pride. *Memphis Med. Month.*, 42: 105, 1921.
9. MacPherson. *Bull. Lying-In Hosp.*, 10: 168, (April) 1916.
10. Schugt. *Zentralbl. f. Gynäk.*, 50: (April 24) 1926.

WILM'S TUMOR*

DAVID N. INGRAM, M.D.

Surgical Staff, Canonsburg General Hospital

HOUSTON, PA.

A RATHER unusual case of a retroperitoneal tumor, is sufficiently interesting to be presented because of its histological structure. Dr. Ramsey reported that frozen sections showed the tumor to be a carcinoma and later sections confirmed the diagnosis of an adeno carcinoma. Further study revealed the presence of stroma or connective tissue cells, thus establishing the final classification of the tumor as a Wilm's tumor or adeno sarcoma.

In a search through the literature practically every conceivable type of sarcoma has been described as a primary tumor when found retroperitoneally, whereas carcinoma in this locality is considered only as a metastatic growth. However, Hansman and Budd[1] of Iowa City in 1932 report seventeen tumors similar to neoplasms arising in the adult urogenital tract and their conception is that these tumefactions arise from remnants of the urogenital apparatus and are therefore congenital in origin and develop by histogenesis. Judd and Lawrence[2] state that the so-called Wilms' tumor is the most frequent retroperitoneal tumor occurring in childhood. They quote Fraser as saying that this sarcoma in its early stages is, paradoxically enough, really a carcinoma, as its origin in the "renal rests" would indicate. With age, Fraser continues, metaplasia takes place giving rise to the sarcomatous characteristics usually noted. It is because of this Dr. Jekyl and Mr. Hyde or dual personality that we note the varied types of metastasis, by way of the lymphatics early and later by way of the Blood stream. In this case of a fifteen year old male, the rapid growth of the tumor, the age and the wide-spread and varied metastasis are manifested. I believe that the removed tissue showed an adeno carcinoma, the early stage of a rapidly growing Wilms' tumor with its origin in a "fetal rest."

J. B., fifteen year old male, presented himself complaining of a "Swelling above the right hip" which had first been noted about ten days before and which had been "getting bigger right along." About a month before this he states that his brother "bumped his right hip." Any trouble in this area previous to this was strenuously denied but he did admit that his "back had been sore at times" during the preceding month. There had been a considerable loss of weight during this time but no cough or night sweats had been present. His complaints also included shortness of breath, weakness and tachycardia upon exertion.

The family history reveals that the mother died eight years ago of pulmonary tuberculosis.

In his past history measles and mumps were the only diseases the patient had had. Although he was never a rugged child his habits were normal, he was a good student but did not enter into the more strenuous athletic activities.

On examination on admission to the Canonsburg General Hospital March 26, 1935, the lad was evidently quite ill, evidently in pain and his complexion was sallow. The heart rate was 104, blood pressure 106/72, but no cardiac pathology could be ascertained. At this time the lungs were resonant throughout and no rales were noted. Upon palpation of the abdomen a hard tense mass was found parallel to the crest of the ilium extending from the lumbar muscles posteriorly to the outer edge of the right rectus muscle anteriorly with a sense of fluctuation. Paracentesis of the mass yielded a sanguineous fluid containing large flecks of apparently purulent exudate which tended to

[1] Hansman and Judd, Massive Unattached Retroperitoneal Tumors. *J. A. M. A.*, (Jan. 12) 1932.

[2] Judd E. Starr and Lawrence. Abdominal tumors. *Surg. Clinics N. A.* (Aug.) 1932.

* Read before the Washington County Medical Society. Meeting September 11, 1935.

clog the needle. The mass itself was approximately 7 × 12 cm. evidently lying under the fascia of the external oblique muscle. Post-

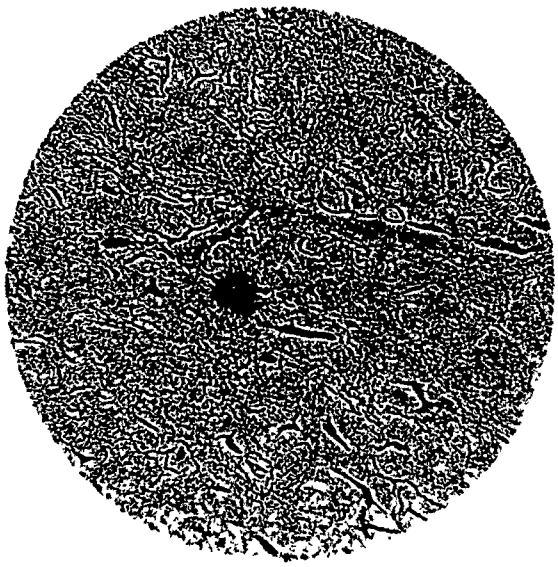


Fig. 1. Sarcomatous areas under low power.



Fig. 2. High power magnifications of carcinomatous areas.

teriorly, the lower thoracic and lumbar vertebra deviate in a gentle curve to the left, the maximum deviation being 4 cm. The spinous processes show no depression or kinking. On further palpation nothing was found in the pelvis nor was there enlargement in any of the solid viscera. The genitalia are normal, no enlargement or tenderness in either testis. Rectally, the prostate is small, soft and entirely normal.

The impression at the time of examination was a tuberculosis of the right ilium with the formation of a tense cold abscess, a similar case having been observed on our service earlier. Other possibilities considered were vertebral caries and cold abscess, a pointing appendicial abscess, a pointing perirenal abscess possibly arising in the retroperitoneal lymph glands and lastly—I must confess only for the purpose of placing it on the record—malignancy.

The *x*-ray showed the ilium to be normal thus discounting our first impression of tuberculosis here. However, the body of the tenth lumbar vertebra was compressed somewhat and irregular in outline, suggesting caries at this point.

The urine was negative except for a high specific gravity of 1.032. Red blood cells numbered 5,900,000, and the white blood cells 12,800. The Kahn test was negative.

The next day under avertin-gas anaesthesia a typical gridiron incision was made and the tumor mass was encountered after the fibres of the internal oblique muscle had been divided. The parietal peritoneum had been displaced mesially and anteriorly and the mass was approximately 12 × 18 cm. at its greatest dimensions. Lying loosely between the fascial planes in every direction the appearance was that of glandular tissue. Extending from the lower pole of the right kidney it reached well into the false pelvis and impinged upon the anterior aspect of the transverse processes of the lumbar vertebra. Impossible of dissection or removal in its entirety the major portion of the mass was removed by digital morcellation, the cavity packed and wound closed with the tail of the packing acting as a drain. Needless to say, we regretted ever having opened the patient when the result of the frozen section was heard. On April 8 the patient was transferred to my "Courtesy Service" at Western Pennsylvania Hospital for maximal deep therapy radiation. By this time the involvement of the affected lumbar vertebra was decidedly increased and symptoms due to pressure on the sensory nerve trunks were quite pronounced by May 1st., when involvement of the liver and the lower lobe of the left Lung were readily discerned. On May 20, 2000 c.c. of sanguinous fluid, which on culture showed no bacterial growth, was aspirated from the left thoracic cavity to relieve respiratory and cardiac embarrassment. The liver metastasis grew rapidly until at the time of death on June 7, 1935 this organ was pal-

pated as a hard nodular mass extending down to the umbilicus. No regrowth at the site of the original tumor was noted. Death was due to the toxemia of the malignancy and not to any intercurrent infection.

DR. RAMSEY'S PRELIMINARY REPORT ON MARCH 28, 1935

The tumor is in fragments with friable partly necrotic tissue some of which is of a yellow color and has a fine honeycomb appearance. Other parts are grayish white, finely granular and have a malignant appearance.

Frozen sections of the grayish white areas show a malignant structure. The tumor cells are arranged in alveoli or tubular structure. The cells are highly anaplastic, growing rapidly and have many mitotic figures. The type of the tissue in other areas could not be definitely determined from the frozen sections. It is possible that the tumor is teratoid in origin with a one sided malignant development.

Diagnosis: Retroperitoneal carcinoma.

On April 3, Dr. Ramsey presented his final pathological report.

The gross specimen consists of a large amount of fragmented soft, friable tissue, portions of which are grayish white and the remainder is pale yellow and necrotic in appearance.

Microscopic examination of routine sections show a complicated structure. In some areas there is a marked tendency to papillary growth. In other places the new growth is almost diffuse and appears either as an alveolar or tubular structure with a minimum amount of delicate stroma. The tumor cells are deep staining and vary greatly in size and shape. The cells lining the papillary areas vary from cuboidal to columnar. In other regions the cells are polyhedral and sometimes spindle shaped. The cell cytoplasm in most areas is granular but there are numerous areas where the cell cytoplasm is clear. In the more malignant areas mitotic figures are numerous and the tumor is growing rapidly. Tubular structures frequently show papillary ingrowths. Many areas show the malignant cells to be large and flat resembling transitional epithelium. In some areas the tumor cells are very small, round or oval in shape. The tubular structures are frequently lined with columnar epithelial cells. Extensive areas of necrosis are present. In degenerating areas the stroma takes on a myxomatous character.

Further study of a large number of sections by Dr. Ramsey elicited the following supplementary report. In many areas the stroma of the tumor consists of thick spindle cells whose nuclei contain a rich deposit of chromatin and show many mitotic figures. These spindle cells are large, overnourished and have a malignant appearance. The tumor tissue therefore, contains two types of malignant tissue and since the epithelial structures are typically nephrogenic in origin the tumor belongs to the Wilm type.

Diagnosis:—Wilm's tumor.

SUMMARY

The interesting feature in this case is the notable predominance of tumor cells manifestly having their origin from epithelial tissue. The tumor unquestionably had its origin in renal tissue and inasmuch as the kidney itself was not involved it is my opinion that our tumor originated in a so-called "fetal rest."

PROLAPSE OF RECTUM

CAUSED BY EXTRAPERITONEAL CYST OF WOLFFIAN BODY ORIGIN

GEORGE I. ISRAEL, M.D.

Assistant Proctologist, Jewish Hospital;
Instructor in Anatomy, Jefferson Medical College

PHILADELPHIA, PA.

AN extraperitoneal cyst of Wolffian body origin was encountered during the course of an operation for prolapse of the rectum. Although there are numerous references made to retroperitoneal cysts of Wolffian origin, no reference was found to a case similar to the one reported.

Mrs. A. C., age forty-one years, married was first examined April 12, 1935 for a irreplaceable prolapse of the rectum with loss of control of the bowel movements. She was told by her parents that she had had a prolapse as an infant, but it gradually disappeared. After the birth of her first child twenty-one years previously, the prolapse recurred with loss of control of her bowel movements. The prolapse appeared with any moderate strain, such as standing, voiding or defecation but had been easily replaceable up to the present time. It had been necessary to wear a napkin all these years. She has had four pregnancies, each becoming more difficult because of increasing in size of the prolapse. Deliveries were technically very difficult.

On examination the prolapse was about 4½" in diameter with markedly relaxed sphincter ani. There was no rectal tear. For reduction of the complete prolapse of the rectum Moskowitz operation, obliterating the cul-de-sac, was considered the procedure of choice with a ventro fixation of the uterus and a perineorrhaphy with a possible plication of the sphincter ani.

The patient was admitted to the Jewish Hospital, Dr. S. L. Rubinsohn's service and operated April 24, 1935 under spinal anesthesia reinforced by ether. A paramedian incision was made. An extraperitoneal mass interposed between the bladder and the uterus and the adnexa presented itself after the belly was opened. The uterus and adnexa were adherent at various points to the rectum and portions of the sigmoid making numerous broad adhesions in the true and false pelvis. It was difficult to expose the cul-de-sac because of adhesions. A catheter was passed into the bladder to determine if there was a definite connection between the bladder and the mass. There was no connection. The mass, which was behind the bladder and covered by the peritoneum, was 4½ to 5 inches long, of irregular conical shape. The base was broad and was above the level of the bladder and overrode the bladder. The apex of the cyst was downward and to the left at the pelvic wall. The space of Retzius was entered to free this mass. A provisional diagnosis of cyst of the urachus was made. After complete walling off the wound, the cyst was incised and a heavy white gelatinous material was expressed. The apex of the cyst seemed at this time to become a fibrous cord and was lost deep in the pelvis. The peritoneum was closed and a complete extraperitoneal enucleation of the cyst was begun. The bladder was opened during the dissection of the cyst from its posterior wall. Lack of continuity between the mass and the bladder was confirmed when the bladder was examined from the inside. The bladder was repaired, the catheter being left in situ. A piece of iodoform gauze was placed in the space of Retzius and brought out at the lower angle of the wound which was then closed in the usual manner. We considered it good surgical judgment to discontinue additional surgery at this time.

The patient's recovery was uneventful except for incipient phlebitis of the left leg. Suprapubic drainage was stopped in eighteen to nineteen days. She was discharged on May 15, 1935, twenty-one days after operation. On discharge the patient had no prolapse of the rectum and control of bowel movements was satisfactory.

Pathological Report: by Dr. S. Levine of the Jewish Hospital.

Macroscopic. The gross specimen consists of an oval shaped cystic mass measuring 9 cm. in its longest diameter with a thick and leathery

wall. The internal aspect is studded with grayish placques. The cyst contains gelatinous material.

Microscopic. Section of the tissue shows it to be lined by degenerated columnar epithelium sharp line of demarcation. The subepithelial zone contains numerous bundles of smooth muscle, within which are large aggregations of polygonal cells with dark eccentrically located nuclei. The cells are arranged in linear bundles and are closely related to capillaries and blood vessels. A number of lymphocytes are also present. The cells mentioned are adrenal cortical rests, taking on the cellular arrangement of the stratum glomerulosium and stratum fasciculatum. This cyst is probably derived from the Wolffian body, and has no relation to a patent urachus.

Diagnosis: Urogenital Cyst.

Follow Up: The patient was seen five months after operation. She looked very well and stated that she had been feeling fine; has had no prolapse and has had control of bowel movements. About two months ago while scrubbing the floor, she felt a fullness in the rectum but no prolapse or escape of feces occurred. Examination revealed the abdominal wound in perfect condition, no hernia nor weakness. Rectal examination revealed a sphincter which was very easily distensible but retracted to normal shape. There was a definite loss of muscle tone and sphincteric action. There was a moderate bulge of mucosa seen through the protoscope. The patient was placed in a squatting position and no prolapse occurred.

I will briefly review the embryology* of the pelvic organs. About the end of the fourth week of embryonal life in the human being, the Wolffian bodies are formed along the sides in the lower third of the body, reaching upward to a point where the diaphragm develops and extending downward in the form of the Wolffian ducts to the cloaca. In the fifth to the sixth week of embryonal life, the elements of the primary genital gland covered with germinal epithelium appear just inside the Wolffian bodies. Coincidental with the development of the genital glands there are seen two ducts, situated externally to the Wolffian body, and which extend to the urogenital sinus, i.e., Mullerian ducts. The ovaries are developed from the primary genital glands and the remainder of the genital tract to the introitus is developed from the Mullerian ducts. The Mullerian ducts are at first solid and extend to the urogenital sinus as separate, unfused structures. Later, if the development proceeds normally, the Mullerian ducts run close together and the lower half eventually becomes merged into one structure. The upper part of this structure, the future uterus, acquires a lumen; the lower part remains solid for a longer time and gradually becomes the vagina. As the Mullerian ducts develop there is a corresponding retrogression of the Wolffian ducts, from the seventh to eighth week ending to the sixteenth week. Remnants give rise to pelvic tumors.

1. Parovarium
2. Gartner's duct.

*Graves Gynecology, 3rd Edition, page 470.

COMMENT

1. A congenital cyst of Wolffian body origin encountered in the course of an operation for prolapse of the rectum.

2. Prolapse of the rectum due to this cyst which by its position between the bladder and the uterus caused the uterus to evaginate into and prolapse the rectum outward at every stooping or straining posture.

3. Unusual position of this Wolffian body cyst, i.e., extraperitoneal between the bladder and the uterus.

4. Nature had attempted to obliterate the cul-de-sac by means of adhesions between the rectum sigmoid and adnexa.

5. Enucleation of the cyst resulted in a surgical and functional cure of the prolapse.

TRAUMATIC RUPTURE OF PENIS*

CASE REPORT

THEODORE R. FETTER, M.D. AND EDWARD GARTMAN, M.D.

Chief of Clinic Resident

Department of Urology, Jefferson Medical College Hospital, Service of Dr. David M. Davis

PHILADELPHIA

IT is a strange circumstance that unusual clinical entities have a tendency to occur in groups. Thus, on September 28, 1935, McKay and Hawes, of Charlotte, North Carolina[1] reported a case of traumatic rupture of the penis. On October 7, 1935, a similar case was seen in the Genito-Urinary Out-Patient Department of Jefferson Hospital. In more than a quarter of a century since January 1, 1910, when cross indexes of the records at Jefferson Hospital were started, up to November 1, 1935, there is not another instance of such a lesion in approximately 175,000 admissions. Moreover, in a period between January 1, 1926 and June 30, 1935, almost a full decade, only 10 reported cases of traumatic rupture of the penis could be found in all the medical literature. Because of the nature of the lesion, by virtue both of its rarity and of its location, it is apt to excite considerable interest and it is safe to assume that this number constitutes the greater part of those cases which have come to the attention of the medical profession in that period.

The etiologic factors involved in producing the lesion are self evident. Any blow to the erect penis sufficiently strong to counter balance the coefficient of its elasticity and the tensile strength of the viscus will produce the lesion. Previous infections or cyst formations[2] in the corpora cavernosa, which will reduce this already limited elasticity and tensile strength, may be considered predisposing factors. Although classically the lesion is said to be produced by the "faux pas de coit" of Guyon,[3] or by attempting to "break" a chordee with a sashweight, these agents are not recorded in any of the cases reviewed by us. Indeed, one is struck by the bizarre nature of the causative traumatisms, rolling over in bed,[1,4] accidently banging an erect penis against a toilet seat,[5] bumping into furniture in the dark,[6] and being catapulted against the dash board of a suddenly stopped automobile.[7] These are only some of the strange ways in which the penis has been ruptured.

The pathologic lesion consists primarily of a rupture in the penile fascia with hemorrhage and the formation of a hematoma. Usually one or both of the corpora cavernosa are torn and there may be involvement of corpus spongiosum and urethra. Although the latter complication, rupture of the urethra, is mentioned by every author, it is apparently rare. Only one instance in which it occurred could be found.[7] The hematoma may serve as a wedge between the two fragments of the torn corpus cavernosum and maintain the deformity. The diagnosis is obvious and usually easy.

The treatment instituted depends largely upon whether the urethra has been torn. If it has, there may be dysuria, hematuria, often acute retention and an occasional extravasation into the adjacent corpora. With involvement of the urethra the lesion immediately assumes grave proportions. A retention catheter should be passed at once and conservative measures followed until the edema, ecchymosis and pain have subsided and the extent of the laceration accurately determined. If, however, there has been an extravasation, there must be incision and drainage. The operative measures which must follow depend upon the

* Read before the Philadelphia Urological Society, December 16, 1935.

nature of the urethral tear and discussion of these procedures is not germane to this brief paper.

The simple laceration of one or both corpora cavernosa is treated first preferably by conservative measures, hot or cold compresses as is deemed expedient, support to the penis and scrotum and sedatives to allay the pain and obviate the possibility of erections. If the clot is not resolved in due time and the deviation persists, or the hematoma becomes infected and local suppuration occurs, it may be necessary to remove the clot. The possibility of the use of elastic splints has also been suggested, although, apparently no one has ever used them. The prognosis in uncomplicated cases is always good.

CASE REPORT

A. H., white, single, forty-eight years of age, a native of Turkey and a seaman, presented himself in the Genito-Urinary Department of the Curtis Clinic complaining of a swelling, bluish discoloration and a little pain in the penis, made worse by an erection. All of these symptoms had existed since early the previous morning. The patient's familial and personal medical histories are of no bearing upon the present instance. The patient states that he awoke Sunday morning, October 6, 1935, with a customary erection. The glans penis was caught in a fold of his sleeping garment, and, in effort to disengage the glans, the patient slapped his penis. He both felt and heard something snap, the sound being akin to that of a breaking bamboo stalk. This was followed immediately by moderate pain and considerable swelling of the penis. The patient consulted a physician at once, who, after assuring him that nothing serious had occurred, referred the patient to our Out-Patient Department. In the twenty-four hours between the occurrence of the traumatism and the time the patient was first seen in the Curtis Clinic, no urinary symptoms had developed.

The following day the penis was markedly edematous, diffusely ecchymotic and quite tender, but neither deformity nor blood clot was noted, and applications of hot saline compresses was advised. There was apparently no improvement and he was admitted to the Urologic Ward, October 14, 1935.

Physical examination was essentially negative, revealing a muscular, well built, middle aged white male in excellent health. The blood count and urinalysis were essentially normal; the Wassermann and Kahn tests were negative. His penis at this time was somewhat edematous and blotchily ecchymotic. On the right dorsolateral surface, at about the juncture of the proximal and middle thirds was a firm, slightly tender, almond shaped nodule about the size of a large lima bean. The shaft of the penis distal to the nodule was deviated to the left at a 45° angle. The patient was promptly put to bed, the penis and scrotum elevated upon an adhesive support and an ice cap applied. Sedation was freely administered, 120 grains sodium bromide daily and codeine and aspirin as required for pain; but these did not prevent matinal erections. Later lead water and laudanum compresses were substituted for the ice cap.

Under this regime the edema and ecchymosis subsided but the clot and angulation remained. Finally, on October 26, under gas anaesthesia, the clot was evacuated. A transverse laceration of the penile fascia and right corpus cavernosum was seen, the tear penetrating the corpus about 0.5 cm. and was about 2 cm. long. The penile fascia was sutured but the corpus was not, because the friability of that structure would not retain a suture very well, and the passage of a needle through tissue of such vascularity would only induce further bleeding. Furthermore, the deviation corrected and the interposed clot removed, it was assumed that union would take place and suturing unnecessary. Following operation, the penis was bathed continuously in hot dressings of a saturated solution of potassium permanganate. Convalescence was uneventful and the patient was discharged in nine days. At that time the wound was well healed and the deviation trifling. When last seen in the Out-Patient Department the deformity had virtually disappeared.

CONCLUSION

Because of the infrequency of this lesion, a case of traumatic rupture of the penis, the first seen in Jefferson Hospital in more than twenty-five years, is herein presented, together with a résumé of the treatment and clinical course.

[*For References see p.* 380.]

ACUTE OSTEOMYELITIS OF PATELLA*

MARIO E. STELLA, M.D.

Resident Orthopedic Surgeon, Kings County Hospital

BROOKLYN, N. Y.

A FEW cases of acute osteomyelitis of the patella have been reported recently and the literature reviewed. However, this present case is of interest because of an early diagnosis and excellent result, and may be added to the series of possibly no more than 50 recorded. According to all but one of previous records, diagnosis has not been made until actual septic arthritis has developed and the clinical course has been stormy and protracted.[1] Sinus formation and expulsion of sequestra have not infrequently occurred.[2] Consequently a satisfactory functional result has not been the rule. In one instance, the course assumed such chronicity, that it was difficult to differentiate from tuberculosis preoperatively.[3]

In the series of 51 cases, including his own, reported by Rocher, many were advanced cases necessitating arthrotomy of the knee and in 10 of these total patellectomy was performed.[4] It may be noted that complete and partial ankylosis, and loss of quadriceps power due to interference with the insertion of this muscle occurred in approximately one-third of these patients. In 6 patients ranging in age from five to thirteen years, following total patellectomy the patella regenerated completely. Apparently the patellar cartilage protecting the joint cavity as well as the fibrous periosteal envelope surrounding the knee cap had been spared. When the serious consequences of late recognition and treatment have been realized, it is well to keep this condition in mind in the differential diagnosis of infections involving the knee joint and its periarticular members.

The incidence of this important disease is rather small. Even authorities in the field of diseases of bones and joints either report a single case or none at all in their years of tremendous experience.[5,6,7] In standard textbooks of surgery the clinical entity is entirely disregarded.

It is found usually in children from five to fifteen years of age in whom development of circulation and ossification of this sesamoid are most rapid. Trauma apparently plays some part in lessening the resistance of the patella, but the origin in most cases is purely spontaneous.[4] There is a slight predeliction for males.

The chief complaint is pain about the knee joint which is aggravated by motion and most severe at night. In early uncomplicated cases motion is usually limited and painful to some extent, but in our patient it was entirely unrestricted and painless. The onset may be heralded by a chill and accompanied by elevation of temperature. Tenderness and swelling at first are localized over the patella and the normal depressions surrounding it are maintained. With progress of the illness, the swelling extends to the knee joint proper but the diagnosis should be established before this is advanced too far. In other words, drainage should have been instituted before the onset of frank septic arthritis when the prognosis becomes much less favorable. A synovitis is bound to occur invariably. During the first ten days this may only be a reaction to irritation in the vicinity but later the fluid becomes turbid, purulent, and organisms may be cultured. There is no fluctuation over the prepatellar bursa and no undue redness and tenderness of the overlying skin. Radiographic changes may be noted at this time, i.e., eight to ten days after the onset. Blood cultures

* From the Orthopedic Service of Dr. H. C. Fett, Kings County Hospital, Brooklyn, New York.

need not be positive. In the case reported at this time, the process was fairly well localized throughout the period of illness and the general condition of the patient was never alarming.



Fig. 1.



Fig. 2.

Case Report: On June 24, 1935, L. Di F. male, white, thirteen years of age was admitted to the Orthopedic service of Dr. H. C. Fett at the Kings County Hospital, complaining of pain in the left knee joint. The condition had started spontaneously three days previously and pain had been so severe at night as to keep patient awake. He had not been completely relieved by rest but motion aggravated his pain. On the day of admission he had a chill and felt feverish. His temperature at this time was 101°F. The remaining history was irrevelant.

We observed a healthy, well developed boy with abnormal findings only in his left knee. This region showed slight periarticular thickening and increased fluid with most of the swelling over the patella and just distal to it. The skin about the joint was discolored from applications of tincture of iodine. There was exquisite tenderness over the center and the lateral borders of the patella. The angle of greatest extention was 170° and that of greatest flexion 40°. Motion was slightly painful and there was no lateral instability.

Aspiration of the joint contents yielded 4 c.c. of clear yellow fluid which microscopically showed no increase in cell content and on culture demonstrated presence of Bacillus subtilis extraneous, evidently a contamination. The blood white cell count was 11,600 with 75 per cent polymorphonuclear leucocytes and the red cell count and hemoglobin were normal. The urine was normal, Wassermann negative and sedimentation time twelve minutes. At this time Buck's extension was applied to the leg and continuous hot soaks started.

An *x*-ray taken on June 27 was reported negative for osteomyelitis of the patella al-

though there was suspicion of roughing and destruction of the inferior pole. Conservative treatment was then continued with the thought in mind to institute drainage when necessary.

Pain persisted and swelling increased. On June 29 the fluid obtained on a repeated aspiration of the knee was cloudy and contained many pus cells. Culture of this material revealed presence of Staphylococcus aureus. The temperature fluctuated from 100° to 103°F., the pulse rate following accordingly. Blood culture had been negative persistently.

A roentgenogram taken on July 2 (Fig. 1) showed evidence of calcification and destruction in the patella interpreted at this time as the result of osteomyelitis. Some degree of effusion and infiltration in and about the knee was also demonstrable. That same day under inhalation anaesthesia a linear midline incision was made over the patella. The quadriceps tendon was stripped from the bone and on drilling holes into the patella, blood streaked with pus was evacuated. The soft necrotic bone was curetted and the saucer packed with vaseline gauze. No cast was applied, but the patient was again set in Buck's extension. Microscopic study of the sections of the material obtained at operation showed evidence of acute osteomyelitis of the patella.

The patient made an uneventful recovery. The temperature dropped to normal and remained flat. Discharge decreased and the wound granulated in. On July 24, a plaster bandage from the ankle to the groin was applied and the boy was discharged to the Out Patient Department. Sedimentation rate at this time was already normal. The cast was removed about one month later and the patient has had no further trouble. On Oct. 1, 1935 he had full range of motion of his knee but the operative wound, while not draining, had not as yet been completely covered with epithelium. An *x*-ray taken August 3, 1935 (Fig. 2) showed no evidence of destruction of the patella. The irregularity of the bone noted at this time is a temporary postoperative defect.

SUMMARY

1. Osteomyelitis of the patella is usually recognized rather late in its course when the indication is for more radical treatment and the prognosis for return of function is less favorable.

2. The salient points observed in the present case were: spontaneous onset of pain over the region of the patella, tenderness and swelling over this area, slight loss of motion at the knee and the symptoms of acute infection. Radiological findings became definitely positive about eight days after onset.

3. Diagnosis in this present instance was made early in the acute stage and a good anatomical and functional result obtained.

REFERENCES

1. Sagel, Jacob. Acute osteomyelitis of the patella (osteitis), case report. *Jour. Bone and Joint Surg.*, 16: 4, 959–963, (Oct.) 1934.
2. Christopher, Frederick. Acute osteomyelitis of the patella. *Jour. Bone and Joint Surg.*, 15: 1012–1014 (Oct.) 1933.
3. Raviola, B. Studio Radiologico della Rotula in Condizioni normali e patologiche. *Arch. di radiol.*, 9: 715–776, (July & Aug.) 1933.
4. Rocher, H. L. Acute osteomyelitis of the patella (abstract translation). *Jour. Am. Med. Assn.*, 81. 1563 (Nov. 3) 1923.
5. Phemister, D. B. Unusual forms of osteomyelitis. *Northwest Med.*, 27: 460–466 (Oct.) 1928.
6. Pellegrini, Olivio. Su Alcuni casi di non freguente localizzazione dell' osteomielite acuta. *Arch. di ortop.*, 45: 487–511, 1929.
7. Taddei, Domenico. Sulle Forme non comuni dell' osteomilite ematogena. *Policlinico* (sex. prat.), 32: 41–45 (Jan. 12) 1935.
8. Mumford, E. B. Primary osteomyelitis of the patella. Case report. *Jour. orthop. Surg.*, 3: 583 (Nov.) 1921.
9. North, N. Hunter. A case of primary Haematogenous osteomyelitis of the patella. *New Zealand Med. Jour.*, 33: 376–378 (Dec.) 1934.
10. Manclark, R. A. Osteomyelitis of the patella. *Lancet*, 1: 416–417 (Feb. 25) 1933.

DIVERTICULITIS OF ASCENDING COLON SIMULATING ACUTE APPENDICITIS

JOSEPH A. VISCONTI, M.D.

Associate in Surgery, N. Y. Post-Graduate Medical School and Hospital, Columbia University

HOBOKEN, N. J.

C. V., ten year old boy, was first seen July 24, 1935 because the previous night, he had had a sudden severe pain in the right lower quadrant causing him to double up. In several minutes the pain tapered down to a steady ache in the right lower quadrant, attended with tenderness over the site of complaint. There had been neither nausea nor vomiting. Bread and butter were the only foods ingested six hours prior to the onset. There had been no antecedent constipation. There was a past history of a similar attack exactly one year ago.

Initial examination disclosed persisting pain in the right lower quadrant attended with slight nausea. Little food or water was ingested since the onset. In lieu of a cathartic the parent prudently administered an enema with apparently good results, but with an aggravation of the pain. Physical examination elicited definite tenderness over McBurney's point.

He was returned to his home the following day. A blood count showed 8000 leucocytes and polymorphonuclear cells 69 per cent. Within twenty-four hours another count showed 9300 white blood cells with polymorphonuclears 73 per cent. Symptoms and signs continued without abatement though patient was ambulatory. Operation could no longer be deferred.

Operation. The abdomen was opened through a right rectus incision. The appendix was located and inspection revealed minimal congestion, insufficient to be considered responsible for the symptoms. It was removed and its stump treated to a Dawbarn inversion. Upon further exploration a half-inch teatlike process, that is best described as a miniature appendix was discovered about one inch above the ileocecal junction, on the anterior surface of the ascending colon, near the mesenteric border. Its base was of the same color, consistency and structure as the parent bowel with a discolored, almost black tip. In its gangrenous bulbous tip several fecoliths were palpated. The diverticulum was cut flush with the bowel and accorded the same treatment as the appendix. Dawbarn inversion completed the closure of the stump.

The ascending colon, transverse colon, and about twelve inches of the ileum were scrutinized for other diverticuli not one were found.

The pathological report confirmed the clinical diagnosis of gangrenous diverticulitis. It was of the true type in that all the intestinal coats were present.

The patient made an uneventful recovery.

CONCLUSIONS

While diverticulitis occurs chiefly in males over forty years of age, attacks in children are reported.

Diverticulitis is a disease of the left lower quadrant, but may occur anywhere in the colon, in fact anywhere from the eosophagus to the rectum.

A single diverticulum in the colon is not common.

The case presented bears out Kleb's contention that diverticuli occur at the mesenteric attachment where the intestinal wall is weakest but it does not necessarily exclude its presence elsewhere.

As in appendicitis, recovery from diverticulitis, without operative interference does occur. This is exactly what happened a year ago, as the history of the case reveals.

Appendicitis simulates many other intra-abdominal conditions and the converse holds equally true. It is reasonable to deduce that upon opening an abdomen, a questionable appendicitis ipso facto demands diligent search for simulating conditions that require surgery.

Experience has shown that whenever additional intra-abdominal search is warranted and undertaken, the operator will be rewarded for his vigilance in about 20 per cent of the cases.

ERDMANN, JOHN F. Acute diverticulitis of the colon. *New York Med. Jour.* (June) 1919; *Am. Jour. Obst. and Gynec.*, May 1926.

NEW INSTRUMENTS

INTESTINAL NEEDLES

G. A. HENDON, M.D., F.A.C.S.

Surgeon, St. Anthony's Hospital

LOUISVILLE, KENTUCKY

NEEDLES for suturing and holding peritoneal surfaces in contact have been made to meet the following requirements: (1) to avoid cutting blood vessels in their passage through the visceral structures; (2) to reduce to the minimum the size of the wound made by the passage of the needle in its progress, thereby limiting trauma; (3) to produce a wound conforming to the punctured type that has the faculty of closing in the wake of the producing agent; (4) to facilitate introduction by shapes that may readily be adapted to the contours of the surfaces to be approximated; for example, different degrees of curvature for concave surfaces and straight needles for convexities; (5) needles so equipped that the sutures may be attached in a manner that does not increase the size of the opening in the tissue beyond the diameter of the needle.

To approach as near as possible to the achievement of the ideal, some of these five points must be emphasized at the expense of others; this being one of those numerous refinements that belongs to personal tastes, judgment and complexities of the individual operator. There is only one phase, as far as I can see, that offers common ground for discussion. The needles equipped with attached sutures are selected quite properly to conform in diameter to the suture which they carry. This results in a slender needle that yields easily even to the slightest pressure, especially if it is curved.

Round or taper pointed needles have been used largely for intestinal surgery because of the desire to minimize the possibility of cutting capillaries; also, because of the belief that the intestinal tissues could be pierced readily by a taper point. It requires no stretch of the imagination to realize that more pushing power is required to transfix with a needle having a round point than one which presents even the minimum of cutting surface. I have found that appreciable resistance is encountered in piercing the walls of the stomach, especially when two layers are superimposed, even if one is the jejunum as in gastroenterostomy; also in suturing low, as in the sigmoid and rectum. Other examples are found in introducing sutures into the depths of some remote abdominal recess. Under the circumstances, I have often found that a needle with a round point becomes diverted when pushed into tissue; and, if not tightly clamped in the needle holder, may even make a complete revolution. In attempting to overcome these difficulties, the needle is bent out of shape which makes sewing with it increasingly difficult.

Therefore, I wrote to a manufacturer* about my troubles in this regard and suggested the feasibility of their supplying eyeless needles with a small cutting or bayonet point for intestinal suturing. This firm promptly and cheerfully gave me their cooperation by furnishing a generous supply of such needles, affixed

*Davis & Geck, Inc.

to sutures and having a cutting point according to my suggestion. The twenty day chromic catgut sutures are swaged into the hollow end of half-circle and $^3/_8$ circle atraumatic needles having a special cutting point. This point has been so skillfully designed that it entirely eliminates the disadvantages of the triangular shaped cutting point common to the eyed surgical needles. These atraumatic needles produce a minimum of injury; and, since the cutting portion of the blade is on the under side of the needle, no additional trauma is created nor are blood vessels wounded when tension is placed on the tissues by pulling the needle upward.

Clinically, I have found these new atraumatic needles most satisfactory, entirely overcoming the obstacles mentioned and in no wise increasing the hemorrhage along the suture line. The needle goes through the tissues with the utmost ease, so that the surface contacts are made with greater rapidity and with more delicacy and accuracy than was possible with the round pointed variety of needle. When the task is completed, the needle does not resemble the scarred and distorted veteran of a conflict. This new cutting point atraumatic needle is a most useful contribution to the safety and speed of intestinal surgery.

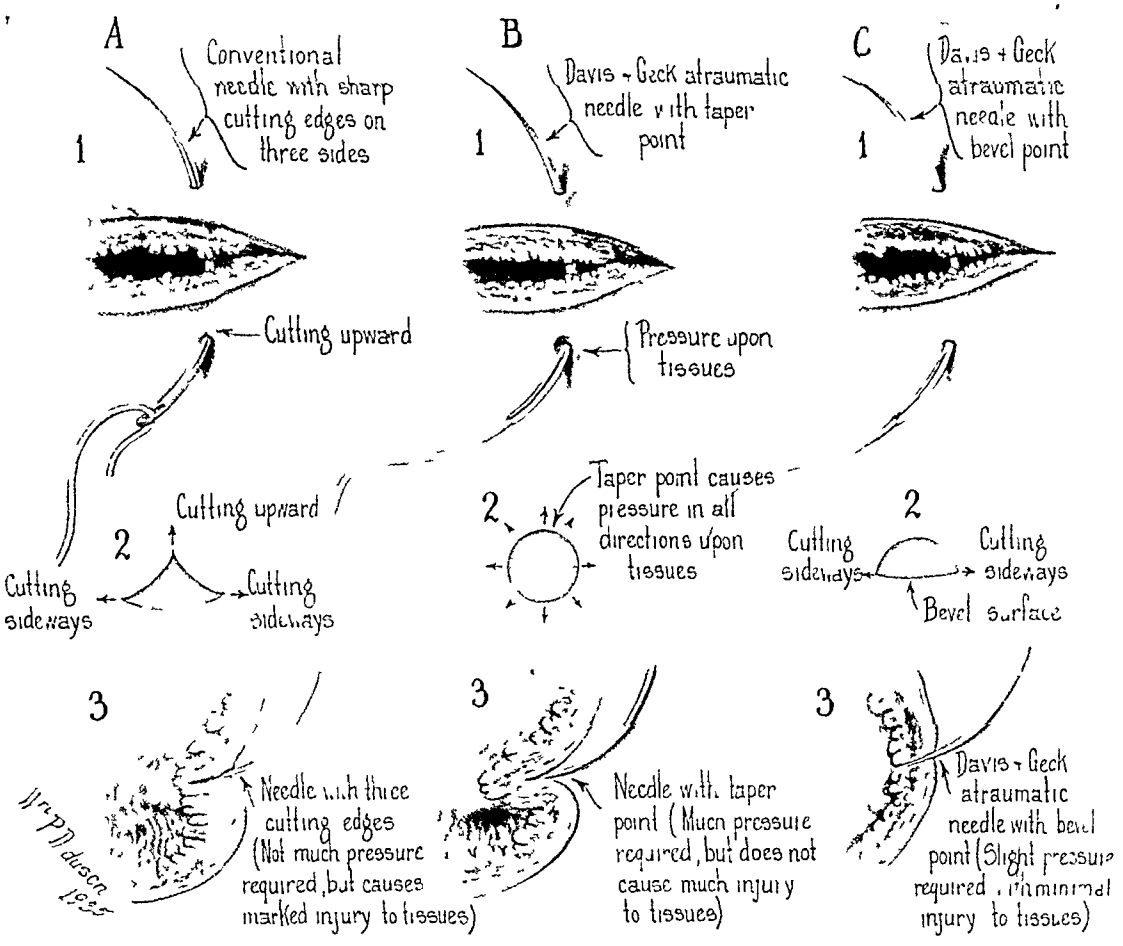


FIG. 1

SILVER STAPLE CLAMP*

LESTER R. WHITAKER, M.D.

BOSTON

FOR years surgeons have known that metallic silver is remarkably well tolerated by the tissues. Silver wire in the form of a "clip" has long been used in neurological surgery to control hemorrhage and the bits of silver remain permanently without the slightest deleterious effect on either nerve or stroma.

There appears to be no contraindication to the general use of silver clips, at least where the field can be kept sterile. This includes the major part of surgery. Even the stone bearing gall bladder, if not grossly inflamed, is in most cases non-infective. One patient in whom silver clips were employed in the removal of a gall bladder containing stones has had no disturbance attributable to their presence for six years; and in more recent cases they have been well tolerated.

Even in infected tissues, silver wire apparently does not inhibit healing. In our laboratory dogs with infected wounds heal even though numerous silver clips have been placed therein. Postmortem examination reveals them solidly embedded in the scar.

The Cushing silver clip and its modifications, though beautifully effective in the brain, do not grip firmly enough for larger vessels in other regions where tissues are more resistant. The Cushing clip is a simple compressed fold of silver wire; apparently a double fold of wire in the form of a staple, similar to those for holding paper, would be more secure. A clamp for the application of silver staples is exhibited.

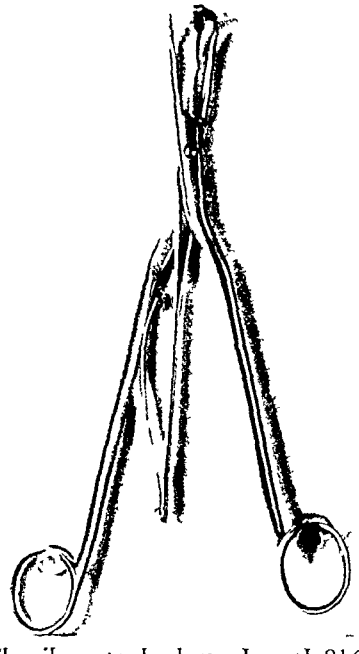


FIG. 1. The silver staple clamp. Length 8½ inches. The handles are adapted to fit the hand.

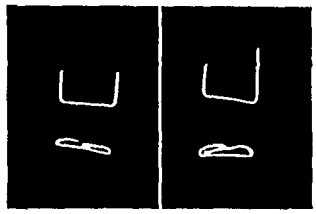


FIG. 2. Showing mechanism. The clamp is loaded for use. The staple, the ends of which overlap as in Fig. 3B, is shown here.

Owing to the thickness of the clamp at the end, it can not be used often in the ordinary way, by setting it into the tissues;

* From the Surgical Clinic of the Massachusetts Memorial Hospitals and the Evans Memorial, Boston, Massachusetts.

the vessel should be held with thumb forceps while the staple is accurately placed. Occasionally the staple can be applied directly to the tip of a bleeding vessel, as the cystic artery.



A B

FIG. 3. A and B. Silver staples of two types, before and after application. Actual size. The ends are cut to chisel points. When staples are closed the ends are folded in such a way that gauze will not catch on them.

This clamp was devised particularly for use in subperitoneal removal of the gall bladder from above downward, where definite vessel bearing strands of tissue are developed between the serosa and the gall-bladder wall. The staples can be applied effectively to these dissected strands of tissue. Time and trouble are thus saved by the avoidance of tying numerous vessels in a deep hole. It appears, also, that the silver staple clamp would be effective in surgery of the breast or thyroid gland.

A smaller and shorter clamp, with a different curvature of the jaws and carrying a smaller staple, could be made for use in neurological surgery where a more secure fixture than the ordinary single fold clip would be advantageous. Numerous adaptations are possible.

The staples are shaped on a special form and cut with a special chisel. By a slight modification the clamp may be made to apply a staple with which one end folds over the other (Fig. 3B) and which perhaps will hold more securely than the ordinary staple (Fig. 3A). Loading the clamp is done by the nurse, who, places the staple with pointed thumb forceps deep in the slot.

REFERENCES OF DRS. FETTER AND GARTMAN*

1. McKAY, H. W. and HAWES, G. A. Traumatic fracture of the penis. *Jour. Am. Med. Assn.*, 105: 1031 (Sept. 28) 1935.
2. BLANC, H. and DUROSELLE. Rupture of penis from encysted hematoma in corpus cavernosum, resection and suture. *Bulletin Soc. Franç d'urol.*, 166, (April 18) 1932.
3. YOUNG, HUGH H. and DAVIS, DAVID M. Practice of Urology, II, Philadelphia, W. B. Saunders Company, p. 160, 1926.
4. BARETZ, L. H. Urol. and Cutan. Rev., 36: 515, (Aug.) 1932.
5. SINKOE, S. J. Traumatic rupture of corpora cavernosa; case. *Am. Jour. Surg.*, 12: 446 (June) 1931.
6. LOWNES, JOHN B. Unreported Case.
7. FRANKENTHAL. Rupture of urethra and corpus spongiosum as a result of a motor car accident. *Zentralbl. f. Chir.*, Leipz., 12: 1598, 1925.
8. REDI, R. Case of fracture. *Jour. d'urol. méd. et chir.*, Paris, 22: 36, 1926.
9. MALIS, J. Collection of cases of fracture of penis; *Arch. f. klin. Chir.*, Berlin, 129: 651, 1924.
10. *KONECNY. *Casp. lék. česk.*, 72: 1460 (Nov. 24) 1933.
11. *TIRVIKOFF, M. V. Rupture of corpora cavernosa; *Vrach. Gaz.*, 34: 1147, (Aug. 15) 1930.
12. *SOMER, W. Case. *Bol. Soc. de Cir de Chile.*, 4: 185 (Nov. 10) 1926.

* These journals not available in Library of College of Physicians, Philadelphia.

* *Continued from p. 372.*

PROCTOSCOPIC ATTACHMENT FOR OPERATING ROOM TABLE

R. RUSSELL BEST, M.D., F.A.C.S.

Assistant Professor of Surgery, University of Nebraska Medical College

OMAHA, NEBRASKA

ALTHOUGH the knee-shoulder position is adequate for routine proctoscopy, it not infrequently proves awkward for both the patient and the doctor when the examination or operative procedure is prolonged. Even in this position, the end of the proctoscope near the examiner's eye will occasionally be lower than the end within the bowel, so that any retained enema solution or liquid secretion may run into the instrument and prove most annoying. For the weak, elderly or incapacitated patient and in operative work through the proctoscope, as obtaining a biopsy or removing a polyp, this position is especially fatiguing for both the patient and surgeon. The lithotomy and lateral positions are mentioned only to be condemned. In every instance, the most satisfactory position for proctoscopy is the inverted or Hanes' position.

There are proctoscopic tables ideal for the office but as they are designed solely for use in rectal procedures, their use in hospitals would require expenditure for a table unsuited for general operative work and a separate room for the table, unless it can be isolated in a corner of one of the operating rooms or the hallway. This expense and the additional space required are hardly warranted. Up to this time, no modification in these tables has been presented which will fill the general operating room requirements and still be advantageous for proctoscopic and rectal manipulations as the various positions required in general operative work have prevented the manufacture of a table with a hip break adaptable to the requirements of proctoscopy. With these factors in mind, I have designed an attachment for an operating table which in no way interferes with its general demands, and yet permits the patient to be placed in the inverted position for rectal procedures. This attachment should be used on tables which have a hydraulic pump control on the foot leaf.

Since all general operating tables are constructed with no break at the angle of the hip, the patient must be turned so that his head is toward the foot of the table. This brings the knee break at the correct place for the hip flexure and by lowering the foot leaf the patient can be placed in an inverted position. The referred attachment consists of a sheet of heavy metal molded to a right angle and attached to a pair of horizontal bars fitted with grips which fasten to the heavy side rails at the foot end of the operating table. The vertical portion of this metal sheet measures 15 inches in height and serves as the platform on which the head and elbows rest when the patient's body is flexed. The 7 inch horizontal metal sheet serves as a support for the horizontal bars. These heavy bars are 14 inches long and extend onto the vertical metal sheet for reinforcement. Bars of lighter metal angle across from the platform to the heavy horizontal bars for further support. There must be no cross bar support for a space of 7 inches between the horizontal bars at the table attachment end to allow for clearing the foot of the table and for adjustment according to the height of the patient.

After the attachment is secured to the foot of the operating table, a folded blanket is laid on the vertical platform and on this one or two pillows are placed. The usual table pad is used. The patient's head and elbows rest against the pillows and the

hands grasp the edge of the platform which has been protected by the blanket. By means of the hydraulic pump, the leg section of the table is gradually dropped and the patient's head gently lowered until he is in the inverted position. Since it is possible for the leg section of the table to descend too rapidly, it should always be supported to assure its lowering slowly. With the Scanlan-Balfour operating table, a fitting with check can be supplied which will prevent the too rapid lowering of the leg section of the table.

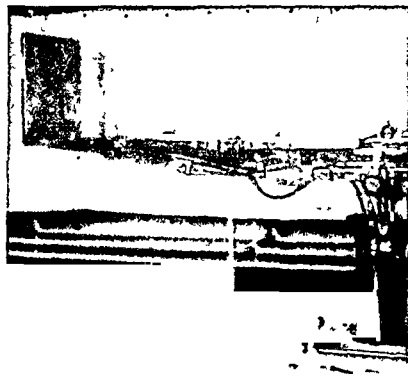


FIG. 1. The apparatus is attached to the foot end of the table.

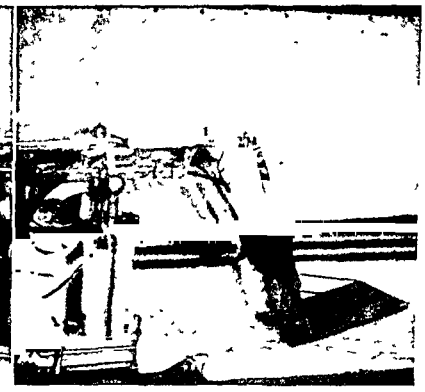


FIG. 2. The foot end is lowered and the patient's head and elbows rest on the platform.

After completion of the proctoscopic examination, the end of the table is elevated by means of the pump. If the examination is to be followed by any type of operative procedure in the prone, lithotomy or side position, the attachment is removed and the table pad and patient are rotated on the central axis of the table until the patient's head is at the usual head of the table.

This proctoscopic attachment has proved highly satisfactory as well as economical to us at the University Hospital and in several of the private institutions. The matter of strain on the table has been carefully discussed with manufacturers and the equipment has been endorsed.

CONCLUSIONS

1. A proctoscopic attachment for a general operating room table which will permit the patient to assume an inverted position had been presented.
2. By using such an attachment, expenditure for a special proctoscopic table is avoided and no additional space is needed.
3. This attachment has proved satisfactory and economical.



[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

TOBIAS SMOLLETT

CARL BECK, M.D.

BRIDGEPORT, CONN.

THE salty flavor of "Perigrine Pickle" ought to be acceptable to a generation of triumphant realism.

Smollett has come to his own. His knowledge of life and fierce energy should give him a high place among the realists. His was not the modern scientific method, characteristic of some of the leading novelists of our own day, but he was a great narrator, who told his story with zest and knew of what he wrote. His experience was extensive and he knew life as it was lived in Marshalsea and the Fleet, at Wapping and St. Giles, in the gaming houses of Covent Garden, in the bagnios of Longacre, with a knowledge that only a turnkey, a seaman, or a genius would have, but also with an understanding of a broad and generous mind. His was a bold and adventurous spirit that took him into the cockpit of a man-of-war, under the walls of Carthagena, in many an English wayside inn, in Jamaica, among the bleak hills of Piedmont, and this bold and adventurous spirit is reflected in his tales, as was all he saw and did and suffered.

Tobias Smollett was born in Dumbartonshire in 1721. His family was the most prominent in the district, the head being the novelist's grandfather, Sir James Smollett. Sir James was bred a lawyer in Edinburgh, represented Dumbarton in the old Scottish parliament in 1688, was Knighted by William III and was appointed to a judgeship. He was a zealous promoter of the union of England and Scotland and served on the Commission that framed the Articles of Union. Later he served in the British Parliament. The youngest of his children, Archibald, (there were four sons and two daughters) married without his father's consent, a young girl of no fortune. The old Knight settled on them the rent of a little property with an income of £200 a year. To the pair were born three children, Jane, James and Tobias.

Tobias attended the grammar school at Dumbarton, wrote verses which, like those of many another Scot, proclaimed the virtues of his native heath and the glories of Scotland. The pages of Buchanan's History gave him the inspiration for his Drama on James I, King of Scotland. At fifteen, he attended the University of Glasgow and for three years (1736–1739) fluttered about its cloisters. He took up his medical studies and was apprenticed to John Gordon, a well known surgeon of the city.

Glasgow had its group of intellectuals, a little knot of college professors, medical

men and clergymen. Hutcheson was then Professor of Moral Philosophy, and Robert Simson, the editor of Euclid, was Professor



FIG. 1. Tobias Smollett, M.D.

of Mathematics. Among the younger men were William Cullen and William Hunter, the future chiefs of British medicine. About half of the professors were clergymen, and if any one had any doubts about Calvinism he kept them to himself.

Smollett was a rebel against the Presbyterianism of the time, a trait he doubtless inherited from his independent Scottish forbears, and never, to the end of his life, did he show any attachment to ecclesiastical forms. He began early to direct his shafts of satire against the money-making pride and religious fanaticism of Glasgow. It is significant that all literary men of the day were in this position of antagonism to theological dogmatism.

Smollett's friends procured him a position as surgeon's mate aboard a man-o'-war. His biographers report his embarkation in 1739 and do not report his return to England until 1744. We know he participated in th "sastrous Carthagena Expedition in 1741. He served on one of the biggest ships of the squadron under Admiral Sir Chaloner Ogle joining Admiral Vinon's squadron in the West Indies, and was on his ship during the whole of the operations of the combined fleet and land forces against Carthagena. We gather that he cruised in these seas for the greater part of 1741 and resided for a time in Jamaica, where he became acquainted with a Miss Lascelles, a Creole beauty, daughter of an English planter. In 1744 he settled in London at the age of twenty-three, setting up his brass plate in Downing Street. He was rather more occupied with talking and writing than with attending the injured, the lame and the halt. It was when his affairs were at their worst that the Creole beauty arrived in London and after a while consented to marry him. In 1747, at the age of twenty-six, he was married and on the strength of his bride's possession of £3000 he took a new house. Unfortunately, the £3000 were not forthcoming, and it took an action at law against certain trustees to recover a portion of it.

Smollett turned to literature without giving up surgery and in 1748 he published "Roderick Random" in two small volumes. The story is in the main a burlesque autobiography and its success was greater than he anticipated.

As late as 1751, Smollett had not given up hope of reconciling literature with medicine. His medical degree he secured in 1749 from Marcschal College, Aberdeen, and he published about this time, "An Essay on the External Use of Water, with Remarks upon the Method of Using the Mineral Waters of Bath." His writings show that the therapeutic use of water was a hobby with him, so that he is one of the forerunners of our modern hydrotherapy.

Had Smollett been a little active in soliciting a practice he might have succeeded, but he was indifferent, and his creative instinct was too much alive, so that "Dr. Smollett" turned more and more to literature.

The Peace of Aix-la-Chapelle opened up France to tourists and Smollett drifted to Paris and wrote "Peregrine Pickle." This novel was twice as long as his "Roderick Random" and had a rapid sale in both England and Scotland but what pleased its author most, was that it was translated into French.

By this time he had become a man of metropolitan note. He took a good house in Chelsea and was visited by many celebrities of the day and by a group of young literary aspirants who drew on the generosity of their amiable host.

In 1753 came his "Adventures of Ferdinand, Count Fathom." The ghastliness of the tale, which treats of a sort of "Jonathan Wild" of a high social strata had been preceded by Fielding's tale and resulted in its having but a short-lived popularity. In 1755 he translated "Don Quixote," published by subscription. Wearied by this task, he decided to visit Scotland and departed for Glasgow. He found his old master no longer a surgeon but a physician of high repute; one or two of his old professors were still alive and at the university; Cullen, not yet removed to Edinburgh filled one of the chairs in medicine. Hutcheson had been succeeded as Professor of Moral Philosophy by Adam Smith. He was welcomed by these distinguished men as one of themselves.

He returned to London and there began a new stage of his career. Baldwin, the bookseller of Paternoster Row, decided to issue a literary journal in opposition to the "Monthly Review." It was to be called the "Critical Review." The first number was issued in 1756. The same year Smollett edited for Dodsley a "Compendium of Authentic and Entertaining Voyages, digested in Chronological Series in seven volumes. In this "Compendium" he inserted several contributions of his own. In 1757 he wrote "The Reprisal of the Tars of Old England, A Comedy in Two Acts," and had the satisfaction of seeing it performed at Drury Lane. The play deals with the capture of an English yacht, aboard which was a young lady and a gentleman, by a French frigate and their ultimate rescue by a British man o' war.

David Hume was at this time laboriously occupied with his "History of Great Britain" and had completed two volumes. The work was proceeding slowly for Hume's efforts were palpably diminishing. The herculean task was accordingly undertaken by Smollett and in 1754, after fourteen months of unprecedented application, he gave to the world in four quarto volumes his "History of England from the Descent of Julius Caesar to the Treaty of Aix-la-Chapelle," containing the transactions of one thousand eight hundred and three years. He made no claim to the use of original documents but only as he himself put it to having presented to the public "a succinct, candid and complete history of England, more easy in the purchase, more agreeable in the perusal and less burdensome to the memory than any work of the same nature produced in these kingdoms."

In an action for libel against the printer instituted by Admiral Knowles, Smollett took the responsibility upon himself and in May, 1759, was fined £100 and sentenced to three months imprisonment. To pass the time pleasantly he wrote the "Adventures of Sir Launcelot Greaves," a travesty on Don Quixote, in which a young English gentleman is the hero, and which gave Smollett an opportunity to exhibit his gifts of social satire.

During the Bute ministry, Smollett edited the "Briton," an organ supporting his unpopular Scottish Prime Minister and his entire government. It was a trying time and before the ministry was over, Smollett broke down in health. He had been working also at his "Continuation of the History of England," a translation of the works of Voltaire in twenty-seven volumes and a compilation entitled, "The Present State of All Nations!" Finally the death of his only, beloved daughter completely prostrated him.

He crossed the channel to Boulogne in June, 1763, proceeded to Nice and resided there from November, 1763 to May, 1765. After an absence of two years he returned to England.

In 1766, an account of his wanderings in Europe appeared in his "Travels through France and Italy." It is written in the form of letters from Boulogne, Paris, Lyons, Montpelier and Nice to a friend in England. These "Travels" are interesting, make profitable reading and give more evidence of his medical knowledge than is to be found elsewhere.

After several months in London, tubercular symptoms again evidenced themselves and in addition he was troubled with rheumatism. He decided upon a journey to Scotland, arriving in Edinburgh in June, 1766. He sojourned here for several weeks, receiving friendly attention from Hume, Robertson, Adam Smith, as well as from Cullen and other luminaries of the medical world. Then he went to Glasgow, living for a time with his friend and biographer, Dr. Moore; thence he and a party of friends journeyed to the Vale of Leven, where he beheld for the last time the scenes of his boyhood. In August, 1766, he returned to England still an invalid and spent the winter at Bath. Here he rallied beyond the most sanguine hopes of his friends.

In 1769 he wrote his satire on public life in England, entitled "History of an Atom."

Smollett was slowly dying and his restless spirit and search for health took him in 1770 to Monte Nova near Leghorn. He was growing weaker and weaker yet the intervals of relief afforded him by the kindly climate of Italy, were spent in literary composition. This was "The Expedition of Humphrey Clinker." The manuscript was sent to London and there published in three small volumes. Soon afterwards he died in his fifty-first year.

After his death, his metrical satires, a metrical tragedy and other verse, published and unpublished, were gathered together and issued.

Three years after Smollett's death, a monument in his memory was erected on the banks of Leven near the house where he was born. The Latin inscription was furnished by Johnson. It is not pleasant to add that his widow seems to have been neglected by her Scotch relatives. She continued to live in Leghorn where she erected a monument over her husband's grave.

This background of biography will, I trust, make clearer the sources of Smollett's inspiration. Fielding, alone of his contemporaries, surpassed him in intellectual power and artistic skill, but Smollett surpassed them all in broad humor and sheer vividness.

II

The first of his novels "Roderick Random."

Notwithstanding the looseness of its construction, it may be considered his best. Fate had it that the tale, considered by many critics as the greatest in our literature, Fielding's "Tom Jones" should follow it. While "Roderick Random" suffers in comparison, it will hold its own with any other novel of its kind, contemporary or otherwise.

It presents the career of a friendless orphan exposed to the snares and pitfalls of a knavish world. The hero is not a gentleman, possesses no very high principles, and there is no pretense that he is one. The tale is picaresque, crowded with queer folk. The characterizations are consistent and the book is pervaded by a broad humor. He drew upon his experience as a surgeon on shipboard and his references to the life of the seaman are authentic and have the minute accuracy of a Dutch painting.

In "Roderick Random," Smollett exhibits in the highest degree all the qualities that made him famous. Here we find them in all their fullness—uproarious mirth, broad farce and broader humanity, truthful delineation and the keen zest for life he retained through all the years of

invalidism. Smollett created immortal English characters that have their counterpart in life. In Bowling we have the honest and manly English sailor, a character unmatched of its kind in all fiction; his hero Random is no mere paragon, he is flesh and blood, though a friendless orphan roaming through a hard world. Smollett would have detested the simpering perfections of the usual hero of fiction, untrue to life as untrue to art.

Perhaps the chief value lies in his authentic revelation of half-devils and half-heroes England has produced in such men as Benbow, Rodney and Hawke. Therein did Smollett render a great service to England and to English literature.

Smollett relies on the interest of pure action. His material is so picturesque, so romantic in the sense of being both strange and terrible that it gains, rather than loses, by his matter of fact treatment. There is no varnish of art in the description of Random's usage at the hands of a lawless crew and the brutal Cramphy on the grim Sussex shore. Here at least, he is supreme; in giving evidence of the truest artistic instinct, telling his tale with the utmost simplicity, with a precious artlessness. Nor is this all. There are quiet descriptions of events and things, full of movement and color—the Scotch parish school, the account of the fearful conspiracy of the boys aided and abetted by Lieutenant Bowling and Rory's coach trip to Bath with the intuition of carrying off an heiress. As in all, in these rollicking novels his gentlemen are ever ready with their swords and his common folk with their fists. Dumas himself, does not provide us with a greater variety of duels.

His humor is broad and infectious, it is that of the sea and the taproom without pretense of refinement and niceness but suited to his tales of the very human sturdy characters he portrays.

In "Perigrine Pickle" he gives us the story of a headstrong, unbridled and dissolute youth, who is wild at school, develops into an unprincipled man and is tamed only in prison. In this character somehow Smollett is able to suggest a capacity for profound love and higher things.

The novel is coarse, sometimes gratuitiously nasty and the author seems to revel in obscenity. But there is a fine spirit of farce and burlesque not characteristic of Roderick Random.

Gamaliel Pickle proposes to the lady of his choice in the terminology of the trades and with commercial curtness. "Madam, understanding you have a heart warranted sound, to be disposed, shall be willing to treat for said commodity upon reasonable terms." His descriptions of his characters tend to exaggeration—written in this spirit of farce. A physician spouts, "Greek and liberty." There is an entertainment given to a French Marquis, an Italian Count and a German Baron. The dishes served are of a horrible conglomeration, the guests maintaining a dignified reserve while undergoing the torture of the evening. Old Pickle and Commodore Trunnion dominated by their wives are treated in a like spirit. Smollett yields freely to his passion for caricature. The blasphemies are fearful, the humor always rollicking and coarse. Nowhere else is such a crew of originals brought together and so vigorously delineated.

In "The Adventures of Count Fathom" we have the career of a hideous and extraordinary scoundrel. Here is the same tendency toward exaggeration of incident and character.

His "Adventures of An Atom" has called forth the admiration of many readers, because of the remarkable gift for satire and allegory here shown. Reckless admirers have even compared him to Rabelais and Swift, but Smollett does not seem to be of the towering genius of these mighty giants of literature. The "Adventures of An Atom" is a political satire. Smollett is said to have been at first a Whig and turned Tory or vice versa and felt himself unduly neglected. The story is an incursion into mock history, extrava-

gant, full of wit and learning. An atom, wandering from Japan, becomes endowed with reason and speech, finds a lodgement in the brain of a one Nathaniel Peacock and causes him to write exactly what it dictates of past history. There are satirical comments on prominent Whig politicians and strange digressions touching upon all manner of things, giving evidence of the author's erudition.

"The Adventures of Humphrey Clinker" has throughout the air of a real diary. The acid, crabbed spinster Tabitha, Humphrey himself and his sweetheart are perfect of their kind and Lismahago, a sort of Scotch Don Quixote, is the glory of the whole company—a source of broad humor and farcical caricature. Some of the scenes are not surpassed for abandon and for the spirit of contempt for propriety and convention. The book is a miracle of rollicking filth.

Smollett made some attempts at the drama, but not very successful. But his "Regicide, A Tragedy" written at the age of nineteen, contains some good material. "The Reprisal" written at a later date is marked by his characteristic humor, in the burlesque presentation of the character of an Irishman, a Scotchman, a Frenchman and an English sailor.

The first biography of Tobias Smollett came from the pen of his friend, Dr. John Moore, which was followed by the Anderson biography and later one from the pen of Sir Walter Scott.

Scott gave his estimate of Smollett in the following words: "We readily grant to Smollett equal rank with his great rival Fielding, while we place both far above any of their successors in the same line of fictitious composition."

Smollett's letters are revealing. Those from abroad exhibit glimpses of the man at his best and they light up phases and objects with many vivid touches. A private letter written under date, London, May 8th, 1763, to one Richard Smith, an American colonial living at Burlington, New Jersey, is worth quoting as it helps considerably in understanding the personality of the writer.

"Sir: I am favored with yrs. of the 26th of February, and cannot but be pleased to find myself as a writer, so high in your esteem. The curiosity you express, with regard to the particulars of my life and the variety of situations in which I may have been, cannot be gratified within the compass of a letter. Besides there are some particulars of my life which it would ill become me to relate. The only similitude between the circumstances of my own fortune and those I have attributed to Roderick Random consists of my being born of a reputable family in Scotland, and my being bred a surgeon, and having served as a surgeon's mate on board a man-of-war, during the expedition to Carthagena. The low situations in which I have exhibited Roderick, I never experienced in my own person. I married very young, a native of Jamaica, a young lady well known and universally respected under the name of Miss Nancy Lascelles, and by her I enjoy a comfortable though moderate estate in that island. I practised surgery in London, after having improved myself by travelling in France and other foreign countries, till the year 1749, when I took my degree of Doctor of Medicine, and have lived ever since in Chelsea, (I hope) with credit and reputation.

No one knows better than Mr. Rivington (a friend of Richard Smith) what time I employed in writing the four first volumes of the "History of England"; and indeed the short period in which that work was finished appears almost incredible to myself, when I recollect that I turned over and consulted over 300 volumes in the course of my labour. Mr. Rivington likewise knows that I spent the best part of a year in revising, correcting and improving the quarto edition, which is now going to press, and will be continued in the same size to the late Peace. Whatever reputation I may have got by this work has been dearly purchased by the loss of health which I am of the opinion I will never retrieve. I am now going to the South of France, in order to try the effects of that climate; and very probably I shall never return. I am much obliged to you for the hope you express that I have obtained some provision from His Majesty; but the truth is I have neither pension nor place nor am I of that disposition which can stoop to solicit either. I

have always piqued myself upon my independency and I trust in God I shall preserve it to my dying day.

Exclusive of some small detached performances I have published occasionally in papers and magazines, the following is a general list of my productions:

"Roderick Random," "The Regicide, a Tragedy," "A Translation of Gil Blas," "A Translation of Don Quixote," "An Essay Upon the External Use of Water," "Perigrine Pickle," "Ferdinand, Count Fathom," A great part of the "Critical Review," A very small part of the "Compendium of Voyages," The complete "History of England and Continuation," A small part of the "Modern Universal History," Some pieces in the British Magazine, comprehending the whole of Sir Launcelot Greaves, A small part of the "Translation of Voltaire's Works," including all the notes, historical and critical, to be found in that translation.

I am very much mortified to find it is believed in America that I have lent my name to Booksellers; that is a species of prostitution of which I am altogether incapable. I had engaged with Mr. Rivington, and made some progress in a work exhibiting the present state of the world; which work I shall finish if I recover my health. If you should see Mr. Rivington, please give my kindest compliments to him. Tell him I wish him all manner of happiness, tho' I have little to expect for my own share, having lost my only child, a fine girl of fifteen, whose death has overwhelmed myself and my wife with unutterable sorrow.

I have now complied with your request and beg, in my turn, you will recommend me to all my friends in America. I have endeavoured more than once to do the colonies some service; and am, Sir, your very humble servant,"

Ts. Smollett

This seems to me to be a manly forethought letter of a man of energy, essential dignity and character, which tells an interesting tale in itself.

Isaac Disraeli in his "Calamities of Authors" says, "Of most authors by profession, who has displayed a more fruitful genius and exercised a more intense industry than Smollett? But look into his life and enter into his feelings and we shall be shocked at the disparity of his situation and the genius of the man. His life was a succession of struggles, vexations, and disappointments—yet of success in his writings."

It is not surprising that under the circumstances Smollett was occasionally swayed by violent prejudices and permitted himself to give vent to injured pride. But "the battle over" says Thackeray, "he could do justice to the enemy with whom he had been so fiercely engaged and give a not-unfriendly grasp to the hand that had mauled him."

His best biographer and friend, Dr. Moore, pictures him from intimate knowledge "of a disposition so humane and generous that he was ever ready to serve the unfortunate. His passions were easily moved; he could not conceal his contempt and detestation of fraud, nor refrain from proclaiming his indignation against every instance of oppression."

His reward did not come in his own day. Such things are reserved for the warrior. That is the way of the mob. But the better minds of his own time and later generations have crowned him.

We know that Smollett shares with Fielding the honor of inspiring modern realism. Dickens in his early days sat at Smollett's feet. "Roderick Random" became the influence of David Copperfield. Our modern literature shows his influence.

Smollett's fame is secure and posterity pays tribute to his genius, his love of truth, his breadth of humanity, and his generous and independent spirit.

BOOK REVIEWS

A TEXTBOOK OF STERILIZATION. By Weeden B. Underwood, B.S. in E.E. American Sterilizer Co., Erie, Pa., 2nd Edition, 1935.

This small book might well be in the sterilizating room of hospitals, or, at least, among the books on the shelf in the operating room supervisor's office. It is thorough and reliable.

The following are the subjects considered: The Destructive Factor in Steam is Temperature, Analysis of the Function of Steam in Sterilizing, The Hand Controlled Method of Eliminating Air and Condensate from the Sterilizing Chamber, The Thermostatic (Automatic) Method of Eliminating Air and Condensate from the Sterilizing Chamber, another chapter on the same "Controlled by Gauging Temperature of Discharge," The Disinfector Type Pressure Steam Sterilizer, The Drying of Dressings, Following Sterilization, and Explanation of Common Causes of Wet Dressings, The Pressure Steam Sterilizer for the Laboratory, Preparation of Materials for Sterilization and Methods of Loading Pressure Steam Sterilizers, Method of Testing the Performance of Pressure Steam Sterilizers, Preparation and Sterilization of Solutions, Water Sterilization, Sterilization of Instruments and Utensils by the Boiling Method, and Sanitary Protective Features.

The cost of this book is two dollars.

THE PRACTIONERS LIBRARY OF MEDICINE AND SURGERY. Volume IX. NEUROLOGY AND PSYCHIATRY. New York, D. Appleton-Century Company, 1936.

This volume on neurology and psychiatry has been prepared under the associate editorship of Dr. James C. Fox, Associate Clinical Professor of Neurology, and Dr. Clements C. Fry, Associate Professor of Psychiatry and Mental Hygiene, Yale University School of Medicine.

The book, consisting of 1234 pages, well bound and printed in large type, has been developed through the cooperation of thirty-nine individuals, who have prepared a total of forty-seven chapters dealing with special phases of neurology and psychiatry. All data has been classified and the chapters arranged as far as possible on an etiological basis, in this fashion departing from the accepted traditional methods of anatomical subdivision. The underlying pathology is stressed throughout the book. There is an attempted intimate correllation of the neurologic and psychiatric phases of each clinical condition discussed, rather than the sharp division into mental or organic classification.

The physician will find an unusual elaborate discussion of the modern concepts of psychopathology and psychoanalysis. The book is literally up to the minute, and although prepared obviously for the general practitioner, will be read with profit and general approval by the specialist in these diseases.

DIAGNOSTIC ROENTGENOLOGY. By Ross Golden, M.D., Editor. New York, Edinburgh, Thomas Nelson and Sons, 1936.

This book of nearly 900 pages will appeal to the surgeon, the cardiologist, the urologist, the orthopedist, the obstetrician and the gynecologist as well as those known to the profession as roentgenologists. Fifteen leading men in their respective fields have contributed to the volume.

A copy of the Table of Contents is self-explanatory:

The Roentgen-Ray Diagnosis of Diseases of the Skull and Intracranial Contents, Cornelius G. Dyke.

The Roentgen-Ray Examination of the Paranasal Sinuses and the Mastoids, G. W. Grier.

Radiology of the Chest, Coleman B. Rabin.

Clinical Roentgenology of the Cardiovascular System, Hugo Roesler.

The Roentgen-Ray Examination of the Digestive Tract, Ross Golden.

The Roentgen-Ray Diagnosis of Diseases of Bones, Paul C. Hodges, D. B. Phemister and Alexander Brunschwig.

The Roentgen-Ray Diagnosis of Spinal Cord Tumors, Cornelius G. Dyke.

Roentgenologic Diagnosis of Diseases of the Urinary Tract, Leopold Jaches and Marcy L. Sussman.

Uterotubography, Samuel A. Robins and Albert A. Shapira.

The Use of the Roentgen Ray in Obstetrics, Howard C. Moloy and Paul C. Swenson.

The Radiology of Fractures, Edward H. Skinner.

The work is profusely illustrated. The Index is ample.

After perusing this book, one feels he has read something distinctly worthwhile when he has finished reading the chapter or sections in which his work and interests take him.

The American Journal of Surgery

is the leading independent surgical Journal. It publishes many papers read before the outstanding Surgical Societies, but it is *not* "the official organ" of any organization. Every manuscript is selected by the editors, as worthy of publication—nothing is published because "it was read at the meeting."

NEW SERIES, VOL. XXXII JUNE, 1936 No. 3

EDITORIAL BOARD

Editor

THURSTON SCOTT WELTON

New York

D. C. Balfour Rochester, Minn.
Carl Beck Chicago
Geo. R. Brighton *New York*
Meredith F. Campbell *New York*
James T. Case Chicago
Isidore Cohn *New Orleans*
W. B. Coley *New York*
F. A. Coller *Ann Arbor*
George W. Crile *Cleveland*
E. C. Cutler *Boston*
R. V Day *Los Angeles*
Charles A. Elsberg *New York*
C. R. G. Forrester Chicago
H. Dawson Furniss *New York*
J. H. Gibbon *Philadelphia*
Emil Goetsch *Brooklyn*
Charles A. Gordon *Brooklyn*
Donald Guthrie *Sayre, Pa.*
A E. Hertzler *Kansas City*
C. Gordon Heyd *New York*
Louis J. Hirschman Detroit
James M Hitzrot *New York*
Frederick C. Holden *New York*
Emile F. Holman *San Francisco*
J. A. Hyams *New York*
R. H. Jackson *Madison*
John E. Jennings *Brooklyn*
W. L. Keller *Washington, D.C.*
H. A. Kelly *Baltimore*
T. J. Kirwin *New York*
Arthur Krida *New York*
A. V. S. Lambert *New York*
H. H. M. Lyle *New York*
Jerome M. Lynch *New York*
Urban Maes *New Orleans*
Harrison S. Martland *Newark*
J. Tate Mason *Seattle*
R. Matas *New Orleans*
Roy D. McClure *Detroit*
H. C. Naffziger *San Francisco*
C. R. O'Crowley *Newark*
Louis E. Phaneuf *Boston*
Eugene H. Pool *New York*
Douglas Quick *New York*
N. P. Rathbun *Brooklyn*
H. A Royster *Raleigh*
Henry S. Ruth, *Philadelphia*
A. C. Scott *Temple*
M. G. Seelig *St. Louis*
J. Bentley Squier *New York*
H. J. Stander *New York*
George W. Swift *Seattle*
Grant E. Ward *Baltimore*
J. H. Woolsey *San Francisco*

EDITORIAL

TUMOR CLINIC IN GENERAL HOSPITAL

SINCE the United States census reports showed that cancer was the second commonest cause of death and that the incidence of cancer was increasing, physicians, statisticians and economists have stressed the economic loss due to cancer in country, state and county. For instance: in Columbia County in 1934 there were 79 deaths and in the city of Hudson there were 30 deaths from cancer; the estimated economic loss to the county was $395,000.

The attack on cancer has been a disappointment. The mortality rate has continued to increase and is greater in the immediate vicinity of medical centres where cancer is extensively treated due to the fact that more cancer patients are attracted to such centres.

Group attack on cancer has been necessary because: (1) the expense of radium, *x*-ray, surgical, laboratory and hospital equipment; (2) the skill and experience required to obtain the best results with such equipment; (3) the impossibility of a large proportion of individuals to stand the financial drain of protracted sickness treated in the modern method.

The most practical form of group attack on cancer is The Tumor Clinic. The term "tumor" is used advisedly in preference to cancer because there are enough benign tumors to dilute the terrors of people's imagination about "cancer." There is a general feeling that the word "cancer" should not be used in contacts with patients, even though a tacit understanding exists as to the nature of the disease being treated.

Today we know that the commonest contributing cause of cancer is irritation; that there are many different varieties of cancer; that some forms are 100 per cent curable if seen early; that most forms are incurable if seen late; that cancer today does not necessarily mean great pain, a surgical operation, huge expense, family bankruptcy and sure death. It depends on what variety of cancer one has. Knowing that

avoidance of chronic irritation of all kinds and the early learning of the truth about ourselves would probably cure more than half of the cases of cancer; knowing that early cancer *is* curable, has been cured and has remained cured over periods of five, ten and even fifteen years; all should do much to free us from the panic of cancer.

Next to the patient himself, the most important individual in the cancer problem is the physician or dentist first seen by the patient.

While campaigns to enlighten the public and to promote periodic health examinations should be encouraged, they will never get very far if advocated only by physicians. People suspect physicians of ulterior motives. Besides periodic health examinations the most hopeful field of cancer prevention is to make general practitioners and dentists realize that most cancer patients will consult them early when the symptoms are common to less serious conditions. It is definitely "up to the profession" to protect their clientele and their own reputations by becoming "cancer conscious." They should prove to themselves that any chronic irritation which has existed for more than a month is not cancer. We have no right to hazard another's chances of recovery by replying on the law of Nature's averages, i.e. that Nature will cure the majority of patients suffering with simple sicknesses. Better to have one living grateful patient than one living "knocker" who has become embittered because one of us may have overlooked a serious condition in its incipience when it was masquerading under minor symptoms.

Great damage has been done to the cancer situation by the blasé willingness of doctors to admit that they do not know the cause of cancer. Much damage has been done by procrastination in making complete examinations. Don't accept the patient's diagnosis of "piles" without an examination. Examine chronic sores, lumps, pigmented moles and cold sores of more than one month's duration; investigate unusual or bloody discharges, especially from breast or uterus; investigate bad teeth and chronic mouth infections; inquire about the excessive use of tobacco and call the patient's attention to the need of doing something to correct these conditions. Too often abstracts of patients' remarks read something like this: "Consulted Dr. ——— so many months ago, and he told me 'to let it alone'; 'let Nature take care of it'; 'it is the change of life'; 'you will outgrow it'; 'it has always been there'; 'my mouth plate makes my mouth sore, so I only use it when I dress up.'"

There are certain mutual advantages in the utilization of the personnel and physical equipment of already existing hospitals for the organization of a tumor clinic, because these represent the established centres in which modern diagnostic and therapeutic procedures can be conducted. These hospitals have the personnel and equipment for this service, and are only lacking in the definite organization together with sufficient radium, a high voltage *x*-ray machine, a radioknife and the all important triad, progressive and unselfish surgeons, competent pathologists and trained radiologists. These are necessary to attain a competent, trustworthy tumor clinic.

Approved general hospitals have already established their reputation in their community and the tumor clinic will benefit by this credit. The affiliation of the tumor clinic with the general hospital is the most economical arrangement possible, as it enjoys the advantages of clinical quarters, hospital beds, interne and nursing staff.

The minimal requirements for a tumor clinic have been outlined by the American College of Surgeons. It should be recognized that the tumor clinic is the scientific antithesis to the "one man racket." It is necessary from the very beginning to combat selfish individualism by convincing the staff that the conquest of cancer is not a one man game, but a problem so large and intricate that it needs the combined skill of physicians who have vision, enthusiasm, energy, ambition and sufficient grasp of the sociologic factor to disarm jealousy and elicit cooperation.

The best answer to the cancer problem to date is the Tumor Clinic. Cancer is not a one man job. The group attack by the formation of a Tumor Clinic in general hospitals when well organized and equipped offers the best approach to the ideal of a 50 per cent reduction in cancer death rate. Group attack is necessitated by the broadness of the subject, the expense and the personnel necessary. The ultimate outcome of any case of cancer is largely determined by the first doctor or dentist consulted by the patient. Much damage has been done to the cause of cancer by the admission that we do not know the cause of cancer; or that we do not know the cure of cancer, by procrastination, by fear of truth, expense or death.

Arthur F. Holding.

TUMORS OF HEAD AND NECK*

Arthur F. Holding, M.D.

Surgeon, Eye, Ear, Nose and Throat Department, Memorial Hospital

Albany, N. Y.

A BRIEF résumé of tumors of the head and neck with the various treatments indicated for the modern therapy of each condition is presented and indicates the wide scope of treatment available in the Tumor Clinic of a general hospital.

Outstanding successes have attended the treatment of basal cell epitheliomata of the skin, naevi, keloids, granulomata; limited success has resulted from the treatment of squamous cell epitheliomata of the lower lip, mouth and tongue, carcinoma of the larynx, lymphomata and lymphoepitheliomata.

Tumors of the head and neck met in the Tumor Clinic and the treatment indicated are as shown on page 394.

TUMORS OF THE EYE

There are many tumors which may be present in the eye region, as xanthoma, verruca, nevus, lymphangioma, lipoma, keloid, fibroma, neurofibroma, neuroblastoma, steatoma, cysts, infectious granuloma, basal cell epithelioma, squamous cell epithelioma and sarcoma. They require only passing comment, inasmuch as their treatment is the same here as elsewhere; namely: surgery for benign lesions which are not radiosensitive; irradiation for malignant conditions and radiosensitive lesions with or without surgery.

It must be borne in mind that irradiation of the eyeball causes cataract and lead eye shields coated with paraffine must be inserted beneath the eyelids when treating radiosensitive tumors of the eyelids.

Special mention should be made of the two commonest tumors of the eyeball: melanoma in adults and neuro-epithelioma, or glioma, of the retina in the very young.

Unilateral loss of vision without pain or infection and with no external signs of disease should suggest the possibility of an intra-ocular tumor.

Melanoma usually originates in nevi in the iris, ciliary body or choroid and is usually primary.

Glioma of the retina occurs usually in children under three years of age; in one-quarter of the cases both eyes are involved. The first symptom is the appearance of a light reflex in the dark like that seen in cats' eyes, with blindness in the effected eye. The treatment for both of these conditions is early enucleation.

* Read as part of a symposium presented by the Tumor Clinic of the Memorial Hospital of Albany before the staff of Hudson City Hospital and Medical Societies of Greene and Columbia Counties, December 10, 1935.

BENIGN TUMORS

Nasal polypi	Surgical treatment of complicating sinusitis; surgical removal; postoperative radium treatment.
Fibromata, Enchondroma	Surgical treatment.
Angioma, Epithelial papilloma	Cauterization or radium treatment.
Giant cell tumor	Curettage, with or without *x*-ray therapy.

MALIGNANT TUMORS

Lymphoepithelioma		*This is a definitely cancerous condition.* In cases presenting unexplained metastases in neck the primary growth is frequently not diagnosed until a diligent search for it is made in the postnasal space by endoscopic examination. These tumors are very radiosensitive, and should be treated by the saturation, Coutard or protracted daily doses of 200 *r* units of high voltage *x*-rays pushed to the limit of toleration.
Carcinoma	Papillary, Basal cell, Squamous cell, Cylindrical cell, Adenocarcinoma	Preliminary radiation, then surgical removal of any residual or persistent tumors. Postoperative radiation.
Sarcoma	Lymphosarcoma, Myxosarcoma, Fibrosarcoma, Mixed types, Osteogenic or Osteolytic	
Endothelioma		Preliminary radiation. Electrosurgical removal of any residue when necessary.
Carcinoma of Larynx		In those rare cases of incipient cancer of the larynx seen early enough to be in a stage where laryngofissure is indicated, the percentage of recovery is 80 per cent; in more advanced cases *x*-ray treatment has shown more than 50 per cent cases cured after five years. Since the standardization of the saturation or Coutard treatment of protracted daily doses of 200 *r* units of high voltage, heavily filtered *x*-rays to the limit of toleration, carcinoma of the larynx may be definitely classified as primarily a radiologic problem, just as carcinoma of the cervix uteri or basal cell epithelioma are now recognized to be best treated by radiologic methods. If laryngeal or dental surgery is contemplated in these cases, it should be done before the heavy radiation is completed to avoid dangers of osteomyelitis or chondritis. In this field deep *x*-ray therapy has for a time virtually supplanted implantation radiation, but there is a field for both methods. In certain quarters early block dissection of the cervical lymph nodes is popular, but few general surgeons have mastered the exacting tedious technique for such operations.

SUMMARY

Success has attended the treatment of certain tumors of the head and neck by surgery, *x*-ray and radium,—namely, basal cell epitheliomata, nevi, keloids, lymphoepitheliomata, granulomata. Ultimately less success has attended the treatment of squamous cell epitheliomata and lymphomata. Benign and malignant tumors of the head and neck with the treatment indicated for each are discussed.

MODERN TREATMENT OF CARCINOMA OF UTERUS*

ARTHUR M. DICKINSON, M.D., F.A.C.S.
Attending Surgeon, Memorial Hospital
ALBANY, N. Y.

OUR present day conception of adequate treatment of cancer of the uterus is based upon the usage of methods other than surgery. We have learned from clinical and postmortem examinations that cancer of the uterus tends to remain localized in the pelvis without widespread lymphatic involvement for a considerable period of time. This coupled with earlier diagnosis is of obvious importance in diminishing the death rate of malignancy of the uterus, which occupies first place as the cause of death from cancer in the female according to present day statistics. In view of the essential differences between cervical carcinoma and carcinoma of the uterine corpus, these will be considered individually.

CARCINOMA OF THE CERVIX UTERI

About 90 per cent of all cancers of the uterus are located in the cervix and commonly occurs during the active period of child bearing; however, it is by no means rare before the age of twenty years. The repeated injuries to the cervix, incident to childbirth and the chronic erosions and infections associated therewith, appear to be important etiological factors. For these reasons, the lesion is more frequent among negresses who usually bear more children than whites.

Modern statistics show that there is a five year cure of about 25 per cent of all cases of carcinoma of the cervix. Obviously the percentage of cures is dependent upon the extent of the growth when discovered and the adequacy of treatment. For example cases falling in group I of the Schmitz classification show a five year cure rate of about 66 per cent; group II shows a 50 per cent five year cure rate; in group III the percentage falls to 20 and in group IV there are no five year cures.

As generally observed from a clinical point of view, cervical cancers are either of the everting, or cauliflower type, or the inverting, or ulcerating type. Here as elsewhere in the body, the malignant lesion which advances to meet you is less dangerous that the one which retreats and burrows away from you. So, the ulcerating type tends to involve other structures earlier and invades the parametrium and lymphatics more promptly than the cauliflower type of tumor. These tumors may also be divided into those arising from the portio vaginalis and in the cervix proper. From a histological point of view, cancer of the cervix is either epidermoid or adenocarcinoma, the former constituting about 95 per cent. A third type of cervical tumor, the adeno-acanthoma represents a combination of these two but accounts for few actual cases. However, the cellular nature of the tumor has little to do with its clinical appearance although it may be of considerable importance in therapy and prognosis. As the tumor mass of the cervix enlarges, it frequently closes the cervical canal with a resultant damming back of secretions into the uterine cavity, thus producing a pyometra. The presence of infected tumor tissue and granulations about the cervix or a pyometra increases appreciably the hazard of treatment of the primary condition. The pathologist grades cervical cancers as I, II, III and IV based upon the amount of differentiation of the tumor cells; we use this grading clinically in classifying these tumors as to their sensitivity to irradiation and as an aid in formulating a prognosis. For statistical

* Read as part of a symposium presented by the Tumor Clinic of Memorial Hospital of Albany before the Staff of the Hudson City Hospital and Medical Societies of Greene and Columbia Counties, December 10, 1935.

purposes, cancers of the cervix are classed into groups depending upon the extent of the lesion. There are several of these classifications, Schmitz, College of Surgeons, League of Nations, etc. The simplest of these is the one of Schmitz; group I includes all cases in which the tumor is limited to the cervix; group II includes those cases in which there is some involvement of the fornices; group III includes cases in which there is real involvement of the parametrium with fixation of the uterus; group IV includes those cases where there is more distant involvement or metastases.

Most patients with carcinoma of the cervix give a history of several labors. They complain that they have had increasing vaginal discharge over a period of weeks or months and there may be bleeding between periods, after coitus or defecation, or the regular periods may be prolonged and more profuse than normal. As a rule profuse bleeding and pain are relatively late symptoms.

Inspection of the diseased cervix, with the patient in the knee chest posture, is the first step in examination; for this, adequate illumination is essential. Next the cervix should be carefully palpated and the examining finger inspected for blood; the fornices are then examined and the mobility and size of the uterus noted. The usual abdominal examination for masses, tenderness or palpable glands is also done. To confirm the diagnosis of cancer, a biopsy is required. This may be done with a punch, scalpel, scissors or electrosurgical loop. Any possible potential risk of biopsy is strongly overweighed by the value of a positive diagnosis and the knowledge of the histology of the tumor. As a means of selecting the area from which tissue is to be removed for microscopic study, the Schiller test is used. In this, the cervix is painted gently with Lugol's solution; normal areas of the cervical tissue stain deep brown on account of the high carbohydrate content of normal cervical epithelium, whereas, diseased areas or tumor tissues do not take the stain because their cells are low in carbohydrates. The test in itself does not indicate malignancy but merely shows us the site of abnormal cells from which biopsy should be taken.

In the treatment of carcinoma of the cervix we have at our disposal, surgery, radium and deep *x*-ray therapy. Modern statistics do not seem to justify surgery as a satisfactory method of treatment. It is true that in group I (Schmitz) cases, surgery does offer as high a percentage of cures as radium but it carries with it an appreciable primary mortality rate of almost 5 per cent, while radium does not. In cases of groups II and III, the results of irradiation therapy are so superior to those of surgery, that the latter can not claim any consideration. Our plan of treatment at the Tumor Clinic of the Memorial Hospital of Albany, includes preliminary deep *x*-ray irradiation of the pelvis through the several known portals; such a course of treatment presumes the delivery of about 3000 *r* units to the skin. This preliminary irradiation clears the infection in and about the cervix and corpus and at the same time delivers a cancericidal dose to many of the tumor cells. Such treatment will require from ten to twenty-one days depending upon the patient's reaction. At the conclusion, radium treatment is given. Fatal peritonitis following primary insertion of radium into the cervix has not been uncommon; the danger of this is minimized by a preliminary course of deep therapy treatments. In our Clinic we have adopted the French technic in which a comparatively small amount of radium is used over a long period of time in contrast to other technics in which large amounts are used for short periods. Numerically, the milligram-hour dosage would be the same whether we used 200 mg. for thirty hours or 50 mg. for one hundred twenty hours. Biologically, however, there seems to be a marked difference in the results obtained with considerable advantage for the French technic. The radium is arranged in capsules each containing 10 to 15 mg. and shielded with

brass, lead or aluminum and also with rubber. In therapy work, only the gamma rays are of value so the alpha and beta rays are eliminated by these filters. The bladder and rectum must be protected to prevent irritation or ulceration. Usually an indwelling catheter is placed in the bladder so that throughout the treatment, the bladder remains collapsed and further away from the source of radiation. One or more capsules of radium are inserted into the cervix; then using the colpostat, further capsules are secured, one on either side of the cervix. Usually we utilize a total of about 50 mg. of radium. After all the radium is in place, the vagina is well packed with gauze to keep the applicators in place and to push away the bladder and rectum. Generally we leave the radium in place for a total of one hundred twenty to one hundred thirty-three hours which gives a total dosage of 6000 to 7500 mg. hours. If the patient becomes too uncomfortable, the radium is removed, a douche given and after a rest period of several hours, the radium is replaced. This total dosage is large but tissues will stand a much greater dosage if given slowly. This large dosage kills off the cancer cells instead of merely devitalizing them and eliminates the need of a repetition of the treatment, the value of which is questionable; furthermore, tumor cells apparently become more resistant with repeated radiation, while cells of the surrounding tissues tend to undergo degeneration. It should be noted in passing that the margin of safety between a cancericidal dose of gamma rays and the lethal dose for normal cells is not great. For recurrences of cervical carcinoma, we have found deep *x*-ray therapy of more value than radium.

CARCINOMA OF THE UTERINE CORPUS

Carcinoma of the body of the uterus composes about 5 per cent of all cases of uterine cancer. Usually it occurs in women at the end of the child bearing period, from forty-five to sixty-five years being the common ages. The association of adenocarcinoma of the body with myomata is quite frequent; probably 10 per cent of cancers of the body are found in association with myoma.

The prognosis in cancer of the body is somewhat better than in cancer of the cervix; the average percentage of five year cures is 33.

We find cancer of the body of the uterus commonly occurring in two clinical forms. In one there is a sharply circumscribed papillary mass that may be easily removed in its entirety with a curette. In the other form there is diffuse involvement of the endometrial lining giving rise to a bulky mass, obviously, growing more rapidly, soon extending through the uterine wall either by the lymphatic channels or by direct extension. The pathologist classifies these growths as papillary adenomas, malignant adenomas and adenocarcinoma. Carcinoma of the corpus tends to remain localized within the uterus for quite a long time and consequently offers a reasonably good prognosis.

The symptoms of carcinoma of the uterine corpus are vaginal discharge or bleeding. There may be some increase in the menses or some intermenstrual bleeding in the woman who has not passed the menopause. In the woman who has, there is often a history of the appearance of a vaginal discharge with spotting. Such complaints justify a diagnostic curettage at least. A negative report on the curettings should not be accepted in face of a positive history but should indicate further investigation.

In our Clinic we have discarded radium in the treatment of cancer of the body. Our reason for this is the ever present danger of forcing infectious material out through the tubes by the insertion of radium and packing; also it is unreasonable to expect to make and maintain satisfactory contact between the radium and the lesion. Following radium treatments, there is still the uncertainty that all the cancer cells have been killed and so resort to surgery must be made. We have adopted as our standard

the use of deep therapy irradiation followed by panhysterectomy. Deep therapy given in satisfactory dosages through the several available portals, tends to sterilize the interior of the uterus and causes death of most of the cancer cells with little risk. At the completion of these treatments, removal of the entire uterus and adnexa is done. It is true that deep therapy treatments do add to the difficulties of operation but these are more than compensated by the greatly lowered incidence of infection and recurrences which follow. Radical surgery of the Wertheim type, without previous deep therapy, has resulted in some satisfaction but even in the hands of the expert it carries a mortality rate of over 10 per cent; for this reason its use is being discontinued in most clinics today. Recurrences after any method are best treated by deep *x*-ray therapy.

SUMMARY

Carcinoma of the uterine cervix is usually of the epidermoid type. Accurate histological diagnosis by biopsy is essential; biopsy risk is very slight. Cervical carcinoma is best treated by a combination of radium and deep *x*-ray therapy; by the use of the deep therapy before radium application, the danger of fatal peritonitis is minimized. Surgical treatment has proved inadequate in comparison to radiotherapy.

Carcinoma of the uterine corpus is usually of the glandular type. Diagnosis can generally be made by a curettage but should be suspected in patients who commence to have discharge or bleeding after the menopause. Carcinoma of the body is best treated by a course of deep *x*-ray therapy, followed promptly by a panhysterectomy.

CANCER OF RECTUM*

WALTER F. PREUSSER, M.D.

Proctologist Memorial Hospital

ALBANY, N. Y.

STATISTICS indicate that a little over 5.5 per cent of all cancer deaths occur from cancer of the rectum and anus, and two-thirds of all colonic cancer are situated at or below the rectosigmoid flexure. This is a fertile field for the reduction of mortality figures, inasmuch as it is readily accessible to the palpating finger and direct visual inspection.

The majority of these tumors unquestionably arise on the basis of preexisting benign adenomata, as cancer and adenoma are frequently coexistent. Yeomans and Horsley both stress the propensity of the adenomata to malignant degeneration. Chronic ulcerative colitis with its sequel, multiple polyposis, is notoriously known to be followed by cancer. Rosser reported a series of cases in which cancer was engrafted on chronic hemorrhoidal disease, fistula and fissure. Obviously, elimination of all chronic rectal pathology and more frequent routine proctosigmoidoscopic examinations are wise prophylactic measures.

It has been determined that the average individual has had suggestive symptoms for a period of eight months before anything except palliative treatment has been employed. The earliest symptomatology is usually that of vague abdominal distress and change in the habitual action of the bowels. There may be abnormal secretion of mucous, perhaps blood tinged and some general debility. Only late in the disease do we get marked weakness, loss of weight, pain and profuse discharge. The elicitation of vague intestinal symptoms during the course of a painstaking history calls for a thorough proctoscopic examination.

The diagnosis of cancer of the rectum is effected by digital and proctosigmoidoscopic examinations together with a study of the tissue removed with the biopsy forceps. The palpating finger is a most valuable piece of diagnostic equipment, as 60–75 per cent of all rectal tumors may be discovered in this manner alone, if the patient is requested to strain in the squatting position. Carcinoma has a distinctive granular or nodular, indurated feel. The vegetative type encroaches on the lumen of the bowel and may be felt as a distinct mass. In the ulcerative type, the finger encounters an indurated border and definite crateriform excavation. In the latter type, there is early invasion of the entire gut wall together with extension to contiguous structures. Fixation is the rule, partly due to the inflammatory reaction of the infection. Introduction of the electrically illuminated proctosigmoidoscope clinches the diagnosis, at which time a biopsy is done. The tissue is sent to the pathologist for confirmation of the diagnosis and to determine the type of tumor, its relative malignancy and radiosensitivity. A roentgenogram is unnecessary in establishing the diagnosis of a lesion which may be palpated or seen with the naked eye. Where there is marked stenosis not permitting the passage of a sigmoidoscope of small diameter, the taking of a barium enema picture is justified. Great care should be exercised in passing the proctosigmoidoscope, inasmuch as perforation of a wall weakened by carcinomatous change is not uncommon.

Cancer of the rectum must be differentiated from amebic granuloma, the granuloma of chronic ulcerative colitis, diverticulitis, lymphogranuloma inguinale otherwise known as lymphopathia ven-

* Read as part of a symposium by the Tumor Clinic of the Memorial Hospital of Albany before the Staff of the Hudson City Hospital and the Medical Societies of Green and Columbia Counties, December 10, 1935.

ereum, hyperplastic tuberculosis and certain benign tumors, as villous papilloma. In the case of amebiasis, the endameba histolytica will be discovered microscopically in the warm, liquid stool and tissue examination will, of course, reveal its granulomatous nature. Diverticulitis is an extramural lesion and simulates carcinoma only in the stenosis it produces. Lymphogranuloma is eliminated by application of the Frei test and the microscopical examination of excised tissue. Hyperplastic tuberculosis, certain benign tumors and the granuloma of chronic ulcerative colitis are differentiated from carcinoma by tissue examination.

Treatment may be palliative or radical and consists of surgery, deep *x*-ray therapy and radium employed singly or in combination. In a recent report of a series of cases, massive coagulation has proved of some value. We believe that a particular type of treatment must be selected for each individual case and that this is preferable to routine methods. The type of treatment selected depends largely on such variable factors as: the age of the patient, his general condition, accessibility of the tumor or its location, degree of obstruction present, fixation of the growth with involvement of contiguous structures and radiosensitivity. Squamous cell carcinoma originating in the anal canal distal to the dentate line metastasizes to the inguinal nodes. These latter must be considered in planning any adequate form of therapy for this lesion.

The most effective surgical procedures are abdominoperineal resection in one or two stages with colostomy, and perineal resection with or without colostomy. Perineal resection is reserved for low lying tumors and should include the sphincter musculature, ischiorectal fat and retrorectal fascia and nodes.

It is our custom in rectal ampullar growths to give a preliminary course of deep *x*-ray therapy. The Coutard or saturation method is used which permits an attack upon the malignant cell in its various phases of reproductive activity. It has a salutary effect in reducing infection; stemming the progress of the disease; mobilizing the tumor when fixed and inhibiting the growth of cells disseminated along the lymph channels. The interstitial implantation of radium emanation seeds is often used for the same purpose. Gold or platinum filtered seeds of 2–3 millicuries each are placed approximately 2 cm. apart. A combination of these remedies is markedly effective in preparing the operable case for surgery and as a palliative measure in the inoperable. Very often the so-called inoperable case responds so well to irradiation that the patient becomes an excellent surgical risk.

CONCLUSION

Reduction of the mortality rate of cancer of the rectum can be accomplished by more frequent routine proctosigmoidoscopic examinations and the eradication of predisposing lesions. Success in the treatment of the disease depends on an early diagnosis established by a painstaking history, digital and instrumental examination. Radium and deep *x*-ray therapy in combination with surgery, planned to suit the particular requirements of the case, is most effective and is recognized as the best available form of treatment.

REFERENCES

Horsley, J. S. Carcinoma of colon. *Jour. Am. Med. Assn.*, 93: 18, 1372–1376 (Nov. 2) 1929.

Preusser, W. F. An instrument to facilitate cancer prophylaxis in the rectum and sigmoid. *Med. Times & L. I. Med. Jour.*, 62: 3, 80 (March) 1934.

Rosser, Curtice. The etiology of anal cancer. *Am. Jour. Surg.*, 11: 2, 328–333 (Feb.) 1931.

Yeomans, F. Proctology, New York, 1929, p. 462.

TUMOR CLINIC AND PATHOLOGIST*

JOHN J. CLEMMER, M.D.
Director, Bender Hygienic Laboratory
ALBANY, N. Y.

THE pathologist's chief obligation toward the tumor clinic is to aid in the diagnosis of the presented cases. That he can enjoy an unprejudiced view of the results of the treatment applied by the surgeon, the internist and the radiotherapeutist also may permit him to judge the merit of various therapeutic measures and perhaps to correlate the work of these important clinical groups. Lastly, he is in a position to encourage and aid programs of investigation and research.

The close association of pathologist and clinician that is made possible by the tumor clinic is of mutual benefit. If the pathologist is to diagnose and attempt to predict the outcome of a given new growth, it is very important that he acquaint himself with the clinical signs and manifestations associated with that neoplasm. The tumor clinic affords him an opportunity to view a questionable lesion in situ and to gain first hand information from his clinical confreres concerning the symptoms and physical signs that the patient presents. In turn, he may suggest methods of study from the laboratory standpoint. Various laboratory procedures may be indicated: gross and microscopic study of a portion of the tumor, bacteriological examinations, serological tests, chemical analyses, and the numerous procedures that are included under the heading "clinical pathology," such as blood counting, sedimentation rates, Aschheim-Zondek tests and urinalysis.

The value of gross and microscopic examination of tissue removed from the living was first emphasized in the middle of the last century, but this practice has become well established only in recent times. At the 1933 convention of the American Medical Association, McGraw and Hartman[1] read an excellent paper on the historical development of the biopsy and its present status. Perhaps the biopsy enables the pathologist to aid in the diagnosis, and to some extent, the prognosis of a tumor better than any other single procedure. If satisfactorily taken and carefully studied it is a source of much information with very little accompanying danger to the welfare of the patient.

There are several acceptable methods of taking a biopsy. If the lesion is on a visible surface and is reasonably small, it should be excised completely with a surrounding rim of normal tissue. If its size does not justify complete excision, a viable portion of the tumor may be removed. If possible, this should be taken from the margin so as to include part of the adjacent normal tissue. Trauma to the tissue by manipulation and squeezing which occurs if scissors, snares or punches are employed, is to be avoided, therefore removal with a sharp scalpel makes the most satisfactory specimens.

It is at times desirable to use some type of electrosurgical or endothermic instrument to facilitate hemostasis and to seal the exposed lymphatics. If such a method is selected, the surgeon should use the high frequency cutting current while removing the biopsy[2] and reserve the coagulating current for subsequent treatment of the field of operation. Coagulated tissue exhibits little or no histologic detail. If the specimen removed is of a reasonable size, the narrow peripheral trauma of the cutting current will not interfere with the microscopic study. We have studied some very satisfactory biopsies of the larynx, bronchi, urinary bladder and prostate removed by the cutting current. The rising popularity of transurethral resections supplies much such material. Also, external surface lesions are removed often by the "radio knife."

The biopsy is also adaptable to tumors beneath the body surface completely surrounded by normal tissue. Here too, if the tumor is small enough, it should be completely excised. However, if necessary,

* Read as part of a symposium presented by the Tumor Clinic of the Memorial Hospital of Albany before the Staff of the Hudson City Hospital and the Medical Societies of Greene and Columbia Counties, December 10, 1935.

there is no great danger in cutting into the mass. Again electro or chemical cautery may be used to minimize any possible danger of stimulating or disseminating the neoplasm. In this connection, Bloodgood has recommended the use of pre and post-operative irradiation.[3]

The aspiration biopsy as described by Martin and Ellis[4] has been highly recommended, particularly for biopsy of tumors beneath the surface. The method requires especial skill on the part of both the clinician and the pathologist, and even in the hands of the group in the Memorial Hospital, New York City where it has been used quite extensively, the procedure has distinct limitations. This group has performed several hundred aspiration biopsies of many types of tissue in various locations; lymph nodes, salivary glands, breast, bone, prostate, lung, thyroid, tonsil, antrum, tongue, and other sites. In some instances the procedure has indicated the specific nature of the tumor, in others it has differentiated between neoplasm and inflammation, malignancy and benignity, and ectoderm and mesoderm. At times no diagnosis was possible and in some instances incorrect diagnoses were indicated. If anyone contemplates the use of the aspiration biopsy, he should study the papers of Martin and Ellis,[4,5] Coley, Sharp and Ellis[6] and Stewart.[7] These authors have carefully described the details of the procedure and have indicated its advantages and pitfalls. The method seems to be definitely established as a diagnostic procedure at the Memorial Hospital, New York, but its difficulty probably will prevent its general usage.

The Hoffman punch is an instrument devised by Hoffman[8] of the Memorial Hospital, New York City, for use in biopsy of deep seated tumors. It consists of an insulated tubular sheath containing a lancet pointed steel obturator which projects a short distance beyond the end of the sheath. When the instrument is inserted into a tumor and the obturator withdrawn, a cutting hook near the distal end of the obturator removes a small portion of the tissue. An electrode is then introduced and the puncture tract is coagulated. Lowsley[9] recently described a punch instrument which he has used successfully in obtaining, through the perineum, biopsies of the prostate gland. He recommends its use for other deep seated tumors. These methods have certain merits but they require experience and dexterity on the part of the operator and entail certain disadvantages to the pathologist.

When a biopsy has been completed, if an immediate diagnosis is necessary, the freezing microtome is the best instrument adapted for rapid sections. Other procedures, such as cutting thin slices of the tissue with a razor blade or mounting surface scrapings or teased bits of tissue on a slide, present obvious disadvantages for satisfactory microscopic study. Von Haam[10] has advocated the use of the "Leitz Ultropaque," an instrument which illuminates the stained surface of thick opaque segments of tissue, making a study of the cellular detail readily available. However, the instrument has not won wide acclaim.

However, biopsies should be eventually studied after the slower preparation of sections of paraffin or celloidin embedded tissue. For this purpose, the surgeon may submit the specimen in a preservative, 10 per cent formalin is a satisfactory, commonly used fixative. At times it is desirable to preserve the tissue in the cold and submit it to the pathologist without chemical fixation. This is particularly necessary if any bacteriological procedures, as culture or animal inoculation, are indicated.

The conception that biopsy of a tumor stimulates its local growth and tends to disseminate neoplastic cells has been largely disproved. Wood's[11] experimental work with 673 rats similarly inoculated with Flexner Jobling rat carcinoma, showed no more progress of the new growth in a group that were biopsied ten to twelve days before radical removal of the tumor than in a control group subjected to radical operation without previous biopsy. Metastasis demonstrable at postmortem examination was used as an index of tumor progression. In a review of 7000 patients

Simpson[12] observed no ill effects resulting from biopsy. At the Curie Institute in Paris, biopsies of 825 carcinomas of the lip were performed without evidence of harm to the patients.[1] If one accepts Bloodgood's statement[13] that the chief danger of biopsy lies in a mistaken diagnosis which may lead to an unnecessary radical operation, then he should choose that form of biopsy which gives the pathologist the best possible opportunity to study the lesion.

Under optimum conditions, the biopsy affords a valuable fund of information. It is the accepted method of accurate specific tumor diagnosis. Worthwhile tumor clinic statistics must be based on material diagnosed in this manner. The histologic nature of a neoplasm will often aid in the selection of the proper method of treatment. The pathologist's report may contribute much toward determining the prognosis of a given case.

A great deal has been written on the subject of grading neoplasms to determine their prognosis and their radiosensitivity. Broders'[14,15] grading of carcinomas of the lip into four groups was one of the earliest attempts. Hueper's[16] method of grading malignancy was applied to carcinoma of the cervix. He evaluated twenty variable histologic factors numerically and from the sum of these values placed the neoplasm in one of four sections. Gates and Warren[17] recently published results of grading 5052 epidermoid carcinomas from various sites. The underlying histologic principle of all of the methods seems to be that a well differentiated neoplasm, one closely resembling the host cells from which it originated and a relatively inactive neoplasm, as judged by the infrequency of mitosis and slight invasiveness, should be considered a low grade malignancy. On the other hand, an embryonic appearing or anaplastic new growth with many mitoses and much infiltration is given a high grade of malignancy. The collected statistics seem to definitely indicate that, in general, group I neoplasms have a much better prognosis than those in group IV. However, all the authors admit that the histologic grading of the new growth must be supplemented by various clinical observations.

The histologic criteria that determine the grade of malignancy are essentially the same as those which determine the radiosensitivity. Thus, in general, the higher the grade indicated, the more radiosensitive is a neoplasm considered. Paradoxically, the histologically highly radiosensitive tumors, that melt away under irradiation, often have an ultimately poor prognosis. In this sense, radiosensitivity must not be confused with radiocurability, for many of the so-called grade I carcinomas, histologically relatively radioresistant, eventually may be cured by irradiation. The radiosensitive basal cell carcinomas or nonkeratinizing epitheliomas of the skin, often cured by irradiation, are one of the exceptions to these statements.

In conjunction with the grading of neoplasms, a word might be said about the diagnosis "precancerous" that is often made. Hellwig[18] has written an excellent review of the diagnosis of tumor biopsies. Concerning precancerous lesions, he has concluded: "No morphologic method can decide whether a non-carcinomatous, atypical cell proliferation will actually develop into cancer or prove to be entirely harmless." His solution of such cases is observation with later biopsies, if indicated. Te Linde's[19] recent paper includes photomicrographs of "cancer-like lesions of the uterine cervix" that would tax many a pathologist's diagnostic acumen. He has observed a group of 24 such patients for periods of one to ten years and in spite of no therapeutic interferences, none of the lesions has progressed to recognizable cancer. He quotes Robert Meyer on this subject that "the question of whether a lesion is malignant or benign can be determined only by the patient's subsequent clinical course," and concludes that "there is as yet no microscopic picture from the cervix which can justifiably be interpreted as a transition between the benign and the malignant." If one wishes to use the term loosely, then every lacerated cervix of a multipara or inflamed lip of a pipe smoker is a "pre-cancerous" lesion, but, until the pathologist's technic is improved, he must content himself by occasionally communicating to the surgeon that he is in doubt

about the exact status of a given lesion, and recommend "watchful waiting."

For the last twenty-five years, various attempts have been made to diagnose malignancy by serological methods. That none of the reported methods has gained wide acclaim indicates the unsuccess of this approach to date. MacFarland, Clark, and Friedman[20] recently attempted to confirm the diagnosis of malignancy with Gruskin's cancer antigens in a series of patients with known neoplasms in the Philadelphia General Hospital. They also examined a series of normal controls. They concluded that the test was of little or no practical clinical value. Fuchs' test, a carcinoma reaction dependent upon a highly refined method of determining the non-protein nitrogen of the blood serum, received a similar evaluation when tried by the German workers, Friedl and Kulka.[21] Lundy[22] recently presented a modification of the Lehmann-Facius complement fixation reaction for the diagnosis of carcinoma. Beneficial results may develop from the experimental work of the serologist on the cancer problem but as yet the clinician cannot depend on a diagnosis of malignancy made in this way.

In conclusion, it should be emphasized that deceased patients who have been studied in the tumor clinic should be examined at necropsy whenever possible. No other method permits a more complete study of the progress of a neoplastic process and the effects of instituted therapeutic measures.

SUMMARY

The pathologist's duties toward the Tumor Clinic are to aid in diagnosis, to evaluate various types of treatment and to encourage and direct research. The close association of pathologist and clinician made possible by the Tumor Clinic is of mutual benefit.

Various methods of obtaining biopsy specimens and preparing them for microscopic study are discussed. The danger of biopsy is considered to be minimal. The diagnostic import of the biopsy is stressed; and the grading of neoplasms histologically, with reference to prognosis and to radiosensitivity is analyzed briefly.

The serological diagnosis of malignancy seems to be of little practical value. At present, it is an experimental field which possibly may prove productive.

The importance of necropsy in the study of neoplastic disease is emphasized.

REFERENCES

1. McGraw, A. B. and Hartman, F. W. Present status of the biopsy. *Jour. Am. Med. Assn.*, 101: 1205 (Oct. 14) 1933.
2. Guequierre, J. P. and Weidman, F. D. High frequency currents in performing biopsies. *Jour. Am. Med. Assn.*, 103: 1693 (Dec. 1) 1934.
3. Bloodgood, J. C. Biopsy. *Am. Jour. Surg.*, 24: 331 (May) 1934.
4. Martin, H. E. and Ellis, E. B. Biopsy by needle puncture and aspiration. *Ann. Surg.*, 92: 169, 1930.
5. Martin, H. E. and Ellis, E. B. Aspiration biopsy. *Surg. Gynec. and Obst.*, 59: 578 (Oct.) 1934.
6. Coley, B. L., Sharp, G. S. and Ellis, E. B. Diagnosis of bone tumors by aspiration. *Am. Jour. Surg.*, 13: 215 (Aug.) 1931.
7. Stewart, F. W. The diagnosis of tumors by aspiration. *Am. Jour. Path.*, 9: 801 (Sept.) 1933.
8. Hoffman, W. J. Punch biopsy in tumor diagnosis. *Surg. Gyn. and Obst.*, 56: 829 (April) 1933.
9. Lowsley, O. S. A new device for securing biopsy specimens. *Jour. Urol.*, 33: 417 (April) 1935.
10. Von Haam, E. The importance of biopsy in the diagnosis of cancer. *New Orleans Med. and Surg. Jour*, 87: 153 (Sept.) 1934.
11. Wood, F. C. Diagnostic incision of tumors. *Jour. Am. Med. Assn.*, 73: 764 (Sept. 6) 1919.
12. Discussion by F. D. Weidman following reference 2. *Jour. Am. Med. Assn.*, 103: 1693 (Dec. 1) 1934.
13. Bloodgood, J. C. Biopsy in breast lesions. *Ann. Surg.*, 102: 239 (Aug.) 1935.
14. Broders, A. C. Squamous cell epithelioma of the lip. *Jour. Am. Med. Assn.*, 74: 656 (March 6) 1920.
15. Broders, A. C. Carcinoma, grading and practical application. *Arch. Path.*, 2: 376 (Sept.) 1926.
16. Hueper, W. C. Carcinomas of the uterine cervix. *Arch. Path.*, 6: 1064 (Dec.) 1928.
17. Gates, O. and Warren, S. The grading of epidermoid carcinoma. *Surg. Gynec. and Obst.*, 58: 962 (June) 1934.
18. Hellwig, C. A. The scientific basis of biopsy in tumors. *Arch. Path.*, 14: 517 (Oct.) 1932.
19. Te Linde, R. W. Cancer-like lesions of the uterine cervix. *Jour. Am. Med. Assn.*, 101: 1211 (Oct. 14) 1933.
20. MacFarland, J., Clark, J. H. and Friedman, M. Experiences with Gruskin skin test for the diagnosis of cancer. *Jour. Lab. Clin. Med.*, 20: 468 (Feb.) 1935.
21. Friedl, F. and Kulka, E. Experience with the carcinoma reaction of Fuchs. *Zentralbl. f. Gynäk*, 58: 2896 (Dec. 8) 1934.
22. Lundy, H. W. Complement fixation reactions in carcinoma. *Jour. Lab. Clin. Med.*, 20: 923 (June) 1935.

ALTERNATIVE METHODS FOR RESTORING GASTROINTESTINAL CONTINUITY AFTER GASTRIC RESECTION FOR CARCINOMA

DONALD C. BALFOUR, M.D., F.A.C.S.

ROCHESTER, MINNESOTA

THE surgical excision of malignant lesions of the stomach offers the only prospect of cure, especially if it is done while the disease is confined to the stomach or to those lymphatic structures that can be removed with the growth. Since this is a disease which is otherwise hopeless, the principles of surgical management become most important, because the more safely an operation can be conducted, the greater readiness there will be for the patient to accept immediate operation if the disease appears to be limited to the stomach. The various factors of safety which have been evolved in gastrectomy for gastric cancer have become well known; and, when such principles of management are followed there is a mortality of only 10 per cent or less. Experience has shown that the chief factors of safety are: (1) preparation of the patient for operation, (2) use of the most innocuous type of anesthesia to minimize pulmonary complications, (3) complete removal of the diseased area in the stomach, (4) properly performing the technical details of the operation itself, (5) scrupulous asepsis, (6) the use of methods of restoration of continuity following removal, and (7) after care.

Certainly not the least important of the factors of safety is the choice and performance of the various methods for restoring continuity after a resection is done, and one of the most difficult problems in the development of this field of surgery is that of finding safe methods of gastrointestinal reconstruction. In cancer the most dreaded complication was leakage from a suture line, and various suture angles became known as "fatal" suture angles. With a better understanding of suture anastomosis, such points of particular danger became less of a menace; and with the understanding that undue tension was more often the cause of leakage than any defect in the suturing itself, such accidents became less frequent. Again, the importance of avoiding postoperative gastric retention in every possible way has long been recognized. Furthermore, to make sure of a secure suture line, the anastomosis must be made with healthy tissue. Added to these general factors of safety, the routine of providing ample reinforcement and protection of all suture lines and the duodenal stump has become an established practice. Probably of most importance in a satisfactory gastrointestinal anastomosis is the selection of the safest methods by which it can be accomplished.

The Billroth 1 procedure is an example of an operation which could not be done with safety in the early days of gastric surgery, but which now can be performed in suitable cases with no more risk than other methods of resection. The operation was discontinued because of the high percentage of fatalities due to leakage from the suture line, but now this menace is no greater than in other types of resection. In cancer of the stomach, however, the Billroth 1 operation has a very limited application because it has only one advantage and several disadvantages. The advantage is that in cases of small carcinomas in the antrum, in elderly patients who are not good risks and in whom the duodenum is unusually mobile and of large caliber, the operation can be done more expeditiously than any of

those procedures which involve independent closure of the duodenum; or in rare instances of anatomical abnormalities it is

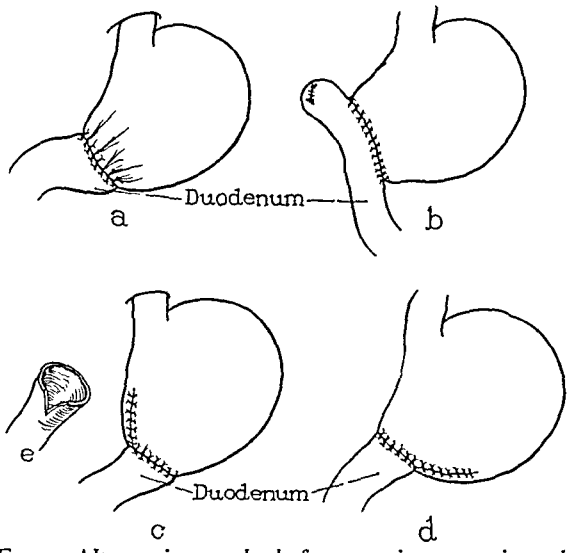


FIG. 1. Alternative methods for restoring gastrointestinal continuity after resection of stomach for carcinoma: *a.* end-to-end anastomosis; *b.* end-to-side anastomosis; *c.* anastomosis of end of duodenum to greater curvature of stomach; *d.* anastomosis of end of duodenum to lesser curvature of stomach, *e.* splitting duodenum to increase perimeter.

not possible or feasible to make use of the jejunum to restore continuity. The conditions, therefore, under which a Billroth I procedure might be indicated are extremely scarce because of the rarity of the conditions just mentioned, and because of the disadvantages, the most important of which are: (1) the attempt to perform such an operation may unduly curtail the scope of the resection, (2) the suture lines are not as secure as when the stomach is united to the jejunum, and (3) if recurrence occurs, it is likely to develop in the vicinity, at least, of such an anastomosis and be responsible for obstruction.

When the operation is indicated, the methods of reuniting stomach and duodenum are many: 1. Occasionally the entire end of the stomach can be united to the end of the duodenum (Fig. 1*a*). 2. The end of the duodenum can be closed and the end of the stomach united to the second portion of the duodenum (Fig. 1*b*, von Haberer-Finney). 3. A portion of the end of the stomach may be closed and the remaining opening of the end anastomosed to either end or side of duodenum; this may be done at either the greater (Fig. 1*c*, Schoemaker) or lesser curve of the stomach (Fig. 1*d*, Horsley), and in certain cases the caliber of the duodenum may be increased at the site of the anastomosis by splitting the anterior wall (Fig. 1*e*).

Segmental resection is probably the simplest and safest method of removing a gastric cancer, yet it is probably the most rarely employed because of secondary disadvantages. When a relatively small growth is centrally located and the stomach is mobile, particularly when it is prolapsed, removal of the segment containing the growth and a direct anastomosis of the ends can be easily accomplished (Fig. 2*a*). The immediate risk of operation is reduced to a minimum. Since gastric function is not as satisfactory after such an operation, and since if a recurrence of the disease should ensue it would probably result in gastric obstruction, the operation is rarely indicated.

Local excision alone for carcinoma of the stomach should be attempted only under exceptional circumstances. The reason for this is that carcinoma rarely develops in or extends toward the greater curvature, and it is only in this situation that local excision alone can be justified. The operation, however, is extremely useful when a small ulcerating lesion is found on the posterior wall high up and near the greater curvature; the difference between local excision and extensive gastric resection is very great from the standpoint of risk, and there is probably little difference in the probabilities of cure between the two operations. Nevertheless, such a lesion is rarely encountered, so that the indications for local excision alone are rare (Fig. 2*b*).

In the greater number of gastric resections the Billroth II procedure is the operation of choice. They are many reasons for this: (1) This type of operation permits the most thorough possible removal of diseased tissue. (2) It is probably as safe as any of

the procedures. (3) It gives good mechanical function. (4) If recurrence of the disease does take place, it is seldom that there is any interference with the gastrointestinal function.

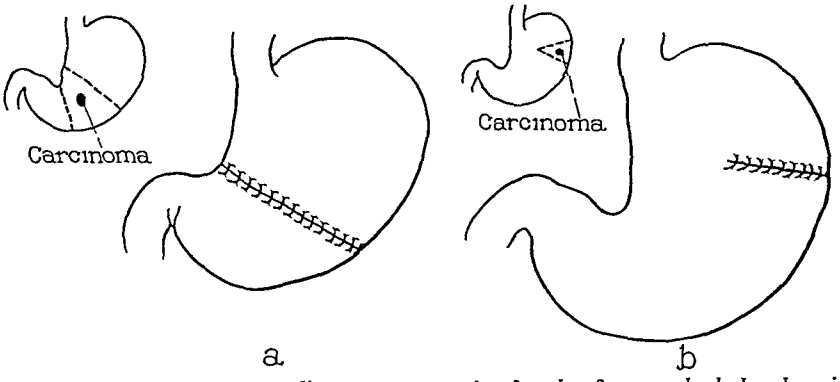


Fig. 2. Segmental resection: *a*. direct anastomosis of ends of stomach; *b*. local excision.

There are many modifications of the Billroth II procedure. Following its original establishment, it became almost universally employed, but with the introduction of methods of anastomosing part or all of the end of the stomach to the jejunum, the operation has been largely supplanted by these latter methods. The chief procedures of this type are: (1) the Billroth II with posterior gastroenterostomy, (2) the Billroth II with anterior gastroenterostomy, (3) end (stomach) to side, (jejunum), posterior, (4) end (stomach) to side (jejunum), anterior, (5) partial end (stomach) to side (jejunum), posterior, and (6) partial end (stomach) to side (jejunum), anterior (Fig. 3*a*, *b*, *c*, *d*, *e*, and *f*).

The most common procedure in this group is the posterior end-to-side anastomosis. The reason for this is that operability of a gastric carcinoma usually denotes a sufficient segment of healthy stomach above the growth to permit a satisfactory end-to-side anastomosis and one which will hang easily through the transverse mesocolon. Furthermore, the entire end of the stomach can usually be used for the anastomosis if, as an early step in the operation, the stomach has been thoroughly emptied of gas and fluid by suction. It is surprising to what extent the stomach will contract under manipulation after it has been emptied. When a posterior end-to-side anastomosis cannot be made easily because of the extent of the resection or the obesity of the patient, or for other reasons, anterior end-to-side anastomosis with entero-anastomosis becomes the operation of choice.

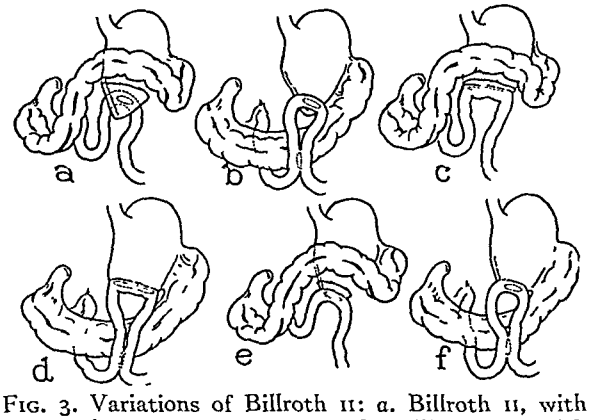


Fig. 3. Variations of Billroth II: *a*. Billroth II, with posterior gastroenterostomy; *b*. Billroth II, with anterior gastroenterostomy; *c*. end (stomach) to side (jejunum), posterior; *d*. end (stomach) to side (jejunum), anterior; *e*. partial end (stomach) to side (jejunum), posterior, *f*. partial end (stomach) to side (jejunum), anterior.

There are, however, specific indications for the other procedures mentioned. The original Billroth II is an exceedingly useful procedure in those cases in which the malignant infiltration has extended so high on the lesser curve that practically all of the lesser curve must be removed. In such cases when a Payr's clamp has been so placed above the growth and the growth removed, it is much safer to close the end of the stomach by a continuous suture behind the clamp than it is to attach the jejunum to the small remaining remnant of the stom-

ach. When closure of the end of the stomach has been completed, gastrointestinal continuity is made by a small posterior or

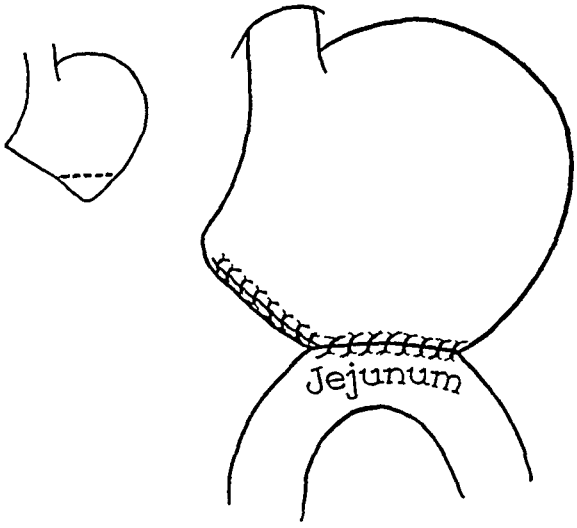


Fig. 4. Triangular piece of greater curvature removed to facilitate gastrojejunostomy.

anterior gastroenterostomy.

It may be said here that it is a safe rule in all cases of anterior gastroenterostomy for a carcinoma that a small enteroanastomosis should be made between the proximal and distal loops of jejunum. A fairly frequent modification of the end-to-side anastomosis of stomach and jejunum is to partially close the end of the stomach before making the anastomosis between stomach and jejunum. In cancer it should be emphasized that the opening between the stomach and jejunum need not be large, for in all methods of reestablishment of continuity the purpose is only a mechanical one, whereas in operations for ulcer, it is apparently true that the cure of the disease depends to a considerable extent on the actual size of the opening between the stomach and intestine.

Many methods of utilizing the remaining portion of the end of the stomach for anastomosis have been described. In some cases anastomosis is facilitated by removing a small triangular portion of the greater curvature (Fig. 4). The general indications for those procedures which involve partial closure of the end of the stomach is when the end of the stomach after resection is considerably larger than necessary for an anastomosis. This can only be determined by the experience of the surgeon, and it

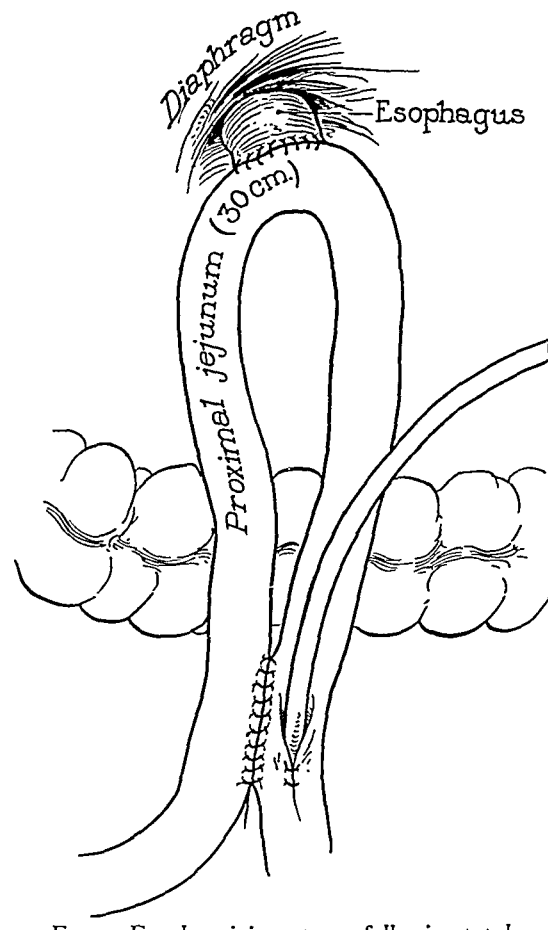


Fig. 5. Esophagojejunostomy following total gastrectomy.

should be noted that even in the case of a highly obstructed stomach a surprising decrease in the perimeter of the end can be obtained by suitable plication of the edge of the cut stomach as the suturing proceeds.

The methods of restoring continuity after total gastrectomy are either with duodenum or jejunum as in partial gastrectomy. In the former instance, after total gastrectomy, it is extremely rare that the portion of the esophagus below the esophageal opening and the stump of the duodenum are sufficiently mobile to permit safe anastomosis. In one case, the anastomosis would have been extremely simple because of the great mobility of the duodenum and the prolapsed esophagus, but

it could not be done because of the infiltration of the duodenum with inflammatory products. Esophago-jejunostomy is, therefore, the method of restoring continuity after total gastrectomy, done preferably in front of the colon, and should always be accomplished by jejunostomy, to permit complete rest of the anastomosis until there is firm healing. (Fig. 5.)

The general principles of anastomosis are well known, and detailed methods of suture will vary with the experiences of the surgeons. It is essential, of course, that meticulous care be taken to control hemorrhage. This should be done by individual ligation of the larger vessels and the proper tension of suture lines to control the smaller vessels in the line of anastomosis. Approximation should be accurate and in attempts to decrease the perimeter of the stomach before anastomosis with duodenum or jejunum, folds of the stomach edge should be avoided, for in such folds imperfect hemostasis is possible. It should, of course, be absolutely free of tension from the suture lines. The suture material should always include some permanent suture, such as silk or linen, and in cancer there is no objection to using such permanent suture material throughout. Our practice at the clinic is usually to employ chromic catgut for the inner row or rows of sutures, and to use silk or linen for the seromuscular sutures. In those cases in which it is suspected that healing will be tardy because of the age or condition of the patient, or because of prolonged obstruction, permanent suture material throughout any anastomosis is probably preferable.

As has been mentioned, it is exceedingly important that the anastomosis should be made in healthy tissue. Probably the most frequent cause of failure of the suture line to hold is because resection has not been done at a sufficient distance from the growth. In certain forms of carcinoma, although the disease may be well demarcated, marked regional gastritis is present, which results in friability of tissue in which sutures tear with the greatest ease and use of such tissue should always be avoided in building an anastomosis. In some cases in which it is impossible to remove all of this inflammatory area, the danger can be avoided largely by independent closure of that portion of the end of the stomach as mentioned elsewhere. It is unnecessary to say that particular care must be taken at all angles of the anastomosis and an important way in which this can be done is by making a routine of continuing approximation of the intestine and the stomach well beyond the actual opening between these two structures (Fig. 6).

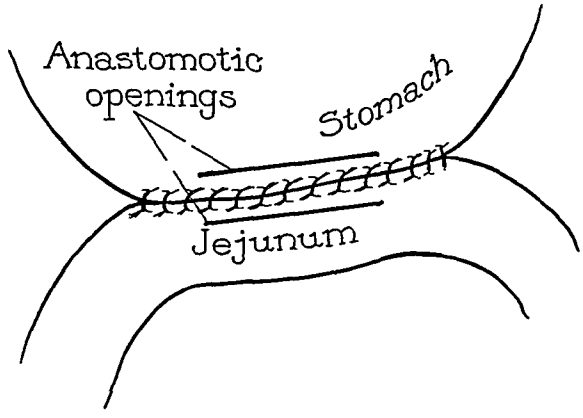


Fig. 6. Extension of suture lines well beyond anastomosis.

When the experience of surgeons throughout the world is applied to the management of cancer of the stomach, it is an excellent example of the surgical maxim that when operation is done early, the patient is given a chance for a cure with a very small risk. In one series at the clinic, there were 200 consecutive gastric resections for cancer, with 10 deaths. In late operations the chances of cure are much reduced and the danger of operation is correspondingly increased.

SUMMARY

The chief factors of safety in carrying out gastric resection for carcinoma are: (1) preparation of the patient for operation, (2) use of the most innocuous type of anesthesia, (3) complete removal of the diseased area of the stomach, (4) proper

technic in the operation itself, (5) scrupulous cleanliness, (6) restoration of continuity following removal and (7) after care.

The methods of reuniting the stomach and duodenum are: (1) anastomosis of the entire end of the stomach and the end of the duodenum, (2) closure of the end of the duodenum followed by anastomosis of the end of the stomach and the second portion of the duodenum, (3) closure of part of the end of the stomach and anastomosis of its open portion with either the end or side of the duodenum.

Segmental resection is probably the simplest and safest method of removing a gastric cancer. Local excision alone for carcinoma of the stomach should be attempted only under exceptional circumstances. In by far the greater number of gastric resections, the Billroth II procedure or one of its modifications is the operation of choice.

The general principles of anastomosis are based on general surgical principles:

1. Hemorrhage should be controlled.
2. Approximation should be accurate.
3. Folds at the edge of the stomach should be avoided.
4. There should be no tension from suture lines.
5. Suture material should include some permanent suture, such as silk or linen.
6. Resection should be done sufficiently far from the growth that anastomosis is made in healthy tissue.
7. At the angles of anastomosis, approximation of the intestine and the stomach should extend well beyond the actual opening.

Operation should be performed as early as possible in the course of the disease.

RECTAL ADMINISTRATION OF EVIPAL SOLUBLE

A SAFE, REVERSIBLE AND CONTROLLABLE PREANESTHETIC MEDICATION
A PRELIMINARY REPORT

JAMES T. GWATHMEY, M.D.

Clinical Professor of Oral Surgery, New York University College of Medicine

NEW YORK CITY

EVIPAL soluble is the sodium salt of evipal, known chemically as N-methylcyclohexenylmethyl barbituric acid. It dissolves readily in water and is generally administered in a 10 per cent aqueous solution, each 1 c.c. of which represents 0.1 gm. of the salt.

This new anesthetic was introduced for intravenous use in operations lasting from ten to twenty minutes. It was originated in Germany where careful laboratory tests were conducted.[1] These showed that when evipal soluble was given intravenously to cats, a dose of 25 mg. per kilo of body weight produced anesthesia, while from 100 to 110 mg. per kilo was necessary to cause death, thus giving a therapeutic index of 4. This is a higher index than that of ether, concededly the safest inhalation anesthetic. In addition, MacMahon[2] states that the therapeutic quotient, that is, the ratio between the effective therapeutic dose and the fatal dose, is 1.3 for phenobarbital, 1.6 for barbital, 2.4 for nembutal and phanodorn, and 4.0 for evipal soluble.

Evipal soluble has been used intravenously over 800,000 times in Europe.[3] In a report[4] on its value by the Anesthetic Committee of the Medical Research Council of Great Britain, 25,000 cases were observed in German clinics with only one death attributed to evipal soluble. From these figures it appears that it is decidedly safer than any other agent at present in use, even when administered by the most approved methods. The British report states: "For those who like intravenous methods, it (evipal soluble) is certainly an admirable means of inducing anesthesia." Jarman,[5] reporting on 2000 intravenous evipal soluble anesthesias, remarks that with certain provisions this agent "has a large scope in the field of safe and useful anesthesias."

In the writer's opinion because of its wide margin of safety evipal soluble will continue to be employed intravenously for short operations and without risk, by those who understand thoroughly the signs of surgical anesthesia. However, some physiologic antidote, such as metrazol[6] or coramine,[7] should be at hand for immediate use in addition to the usual oxygen and carbon dioxide. Without these safeguards, no one is justified in giving evipal soluble intravenously. If administered intelligently, there is an extremely wide margin of safety.

Taking as a basis the laboratory experiments and clinical experiences with evipal soluble intravenously in Europe, as well as the observations of a number of American authorities,[8] I determined to test the drug rectally* using rabbits and dogs, but found that rabbits were not good animals for rectal experiments. However, the fact was established that with 5 mg. of morphine per kilogram of body weight and 50 mg. of evipal soluble per kilogram body weight, 7 of 9 rabbits were analgized with no deaths.

The rectal administration of 40 mg. per kg. of dog of evipal soluble in 10 per cent aqueous solution represents the minimal dose that produces surgical anesthesia, resulted in 2 of 3 of the animals being anesthetized for approximately forty minutes. The other dog was hypnotized but

* The laboratory experiments were conducted in the laboratory of the New York University College of Medicine under the supervision of Professor George Barclay Wallace, with the cooperation of Mr. John S. Reinhart who evolved and conducted the technical details.

THE RECTAL ADMINISTRATION OF EVIPAL SOLUBLE IN DOGS*

Dose of Evipal Soluble, Mg. per Kg.	Number Dogs Used	Number Showing Hypnosis	Number Showing Anesthesia	Duration of Anesthesia, Average
25	3	3	0	
30	1	1	0	
40	3	1	2	41 min.
50	6	1	5	1 hr. 14 min.
75	1	0	1	1 hr. 45 min.
100	1	0	1	7 hrs.
125	1	0	1	10 hrs. 5 min.
150	1	0	1	18 hrs. 45 min.
175	1	0	1	17 hrs.

* Each animal received a dose of 5 mg. per kg. of morphine hydrochloride subcutaneously one hour before the administration of evipal soluble.

not anesthetized. A dose of 50 mg. per kg. produced an excellent surgical anesthesia averaging one hour and fourteen minutes in 5 of 6 dogs. There was complete muscular relaxation within three minutes after the rectal instillation and surgical anesthesia was accomplished with no visible impairment of respiration or heart action. The rectal administration of 175 mg. per kg. of evipal soluble produced surgical anesthesia for seventeen hours with full recovery and no after effects. It is, therefore, evident that the margin of safety for evipal soluble administered rectally in dogs is very great, even when preceeded by a hypodermic injection of morphine. The therapeutic index is over 4.0 (minimal lethal dose divided by the minimal anesthetic dose). Administered intravenously to dogs, the index is 3.3, thus showing a much wider margin of safety when the drug is given rectally and also, and more important, a very much longer anesthesia.

With the above laboratory experiments as a foundation, we have clinically tested evipal soluble per rectum in a little over 150 cases, using it *only* for preanesthetic medication. The supplemental anesthetic in my cases was ethylene and oxygen with open mask,[9] the oxygen ranging from 10 to 75 per cent. However, it may be supplemented by other anesthetics. The results have been entirely satisfactory; pulse, respiration and blood pressure remained normal, except as influenced by the necessary manipulations of the surgeon.

In estimating the amount of evipal soluble to use intravenously, the general rule is: Multiply the body weight in pounds by 0.06 c.c., which determines the maximum amount in cubic centimeters of the 10 per cent solution to be injected. For instance, a patient weighing 150 pounds would receive 9 c.c. (150 multiplied by 0.06 of the 10 per cent solution) as the maximum amount intravenously. The first portion is injected at the rate of 1 c.c. every ten seconds, or until the patient stops counting aloud. The remainder is injected more slowly, 1 c.c. every fifteen seconds. If the intravenous injections is slower than this rate, anesthesia may not ensue as the drug is very quickly detoxicated in the body. If the drug is given too quickly, respiratory arrest may occur, which is alarming but not usually fatal.

When evipal soluble is given rectally, as a preanesthetic medication we use as our index 0.2 c.c., that is, a patient weighing 150 pounds would receive 30 c.c. (150 multiplied by 0.2) of a 10 per cent aqueous solution of evipal soluble. In addition, we always add ¼ grain of morphine to the solution. The patient is usually asleep within five minutes after the solution is instilled into the rectum. There is no rectal irritation.

The dose is also determined by the age, conditions, habits and state of health, as well as by body weight. A man or woman accustomed to alcoholic drinks or vigorous exercise would require the full amount or even more than the index demands. Athletic alcoholics have received 30 c.c. of evipal soluble solution rectally with little or no appreciable effect. An anemic, undernourished individual should receive just a little less. A rectal dose of 30 c.c. will produce quiet sleep in over 80 per cent of the cases; in the others, a restful disposition. In either case, supplemental anesthesia, inhalation, local or spinal, will be needed to complete the narcosis for a major operation. This preanesthetic medication may be complete without a supplement for such operations as opening an abscess, setting a fracture, reducing a dislocation, etc.

Relaxation is better following evipal soluble than with any other preanesthetic medication at our disposal. When properly supplemented, the relaxation of muscles is equivalent to spinal anesthesia. It is safer because its action is controllable and reversible with metrazol and carbon dioxide and oxygen at all times. As evipal soluble per rectum effects only the sensory nerves and has no effect whatever upon the heart, it is an unusually safe basal anesthetic. We have never had to use either metrazol or carbon dioxide and oxygen, even when the amount far exceeded the standard dose of 0.2 c.c. per pound. No other barbiturate should be used in association with or prior to evipal soluble. The sleep induced with the stipulated amount per rectum never requires the presence of an anesthetist, as there is no falling back of the tongue or jaw. The drug can be given by any trained nurse in the patient's own bed. We know of no contraindication for its use.

The technic is simpler and easier than with oil-ether per rectum. The patient should have a sodium bicarbonate enema

CITY HOSPITAL, WELFARE ISLAND, N. Y. C.
March, 1936

Operation	Weight	Age	Amount Rectal Evipal Soluble, Grams	Sleeping after Evipal, Minutes	Supplemental Medication in Evipal Soluble	Terminal Anesthetic	Blood Pressure		Relaxation	Postoperative Nausea	Remarks
							Preoperative	Postoperative			
Thyroidectomy	122	43	2 5	10	Magendie solution m VII	$N_2O + O_2$	136/76		Very good	None	Reacted on reaching ward
Plastic of neck (2 hours)	142	21	3	9	Dilaudid gr 1/48	$C_2H_4 + O_2$	150/100	128/90	Very good	None	Reacted in 1 hour, restless
Thyroidectomy	138	25	2 5	10	Magendie solution m VII	$C_2H_4 + O_2$ + ether	118/80	126/78	Not satisfactory without small amount ether vapor	Yes	Reacted in 55 minutes, restless
Cholecystectomy	140	43	3	8	Dilaudid gr 1/48	$C_2H_4 + O_2$ + ether	138/84	130/78	Very good	None	Reacted 5 hours postoperatively, restless
Abdominal exploratory	110	48	2	6	Dilaudid gr 1/48	$C_2H_4 + O_2$ + ether	112/68	100/54	Very good	None	Reacted quietly, 1 hour, 50 minutes postoperatively
Femur, closed reduction	100?	85	1	4	Dilaudid gr 1/48	$C_2H_4 + O_2$	120/60	110/68	Very good	None	Reacted quietly, 2 hours postoperatively
Thyroidectomy	110	45	2	10	Dilaudid gr 1/48	$C_2H_4 + O_2$	146/105		Very good	None	Reacted 1 hour, 40 minutes postoperatively
Humerus, closed reduction	120?	84	1 5	3	Dilaudid gr 1/96	None	not	taken	Very good	None	Reacted 2 hours postoperatively, restless
Thoracotomy	140	41	3	18	Dilaudid gr 1/48	Local	122/78	110/60	Not satisfactory	None	Alcoholic, reacted 1 hour postoperatively
Thoracotomy	114	35	2	6	Dilaudid gr 1/48	Local	118/72	128/30	Not satisfactory	None	Alcoholic, reacted on table in operating room.

two hours previously, although this is not always necessary. Dissolve 3 gm. of evipal soluble in 30 c.c. of distilled water and then aspirate the calculated dose into a 30 c.c. glass syringe with needle attached. Dissolve ¼ grain of morphine in a small amount of water and aspirate this solution into the syringe with the evipal soluble solution. Replace the needle with an infant catheter that will fit snuggly on the end of the syringe. With the patient comfortably placed on the left side, lubricate and insert the catheter about 4 inches into the rectum and inject the complete solution rapidly. Instill into the rectum an additional 10 c.c. or more of water. Clamp the

CITY HOSPITAL, WELFARE ISLAND, N. Y. C.

Rectal Evipal

Operation	Weight	Age	Amount Rectal Evipal Soluble, Grams	Sleeping after Evipal, Minutes	Supplemental Medication in Evipal Soluble	Terminal Anesthesia	Blood Pressure		Relaxation	Postoperative Nausea	Remarks
							Preoperative	Postoperative			
Thyroidectomy	122	50	2	6	Dilaudid gr 1/48 gr 1/96	Ether vapor 10 minutes only	122/60	110/62	Very good	Vomited twice after fluids were given	Reacted quietly 3½ hrs postoperatively (Ether used at surgeon's request)
Thyroidectomy	148	16	3	9	Dilaudid gr 1/48 gr 1/96	Ether vapor	146/60	140/66	Very good	Vomited once after fluids were given	Reacted 4 hours postoperatively, restless (Ether used at surgeon's request)
Cholecystectomy and appendectomy	142	49	2 5	8	Dilaudid gr 1/48	$N_2O + O_2$ + light ether vapor	152/80	138/82	Very good	None first 24 hours	Reacted 6 hours postoperatively, restless
Incision and drainage of rectroperitoneal abscess	100	25	2	12	Dilaudid gr 1/96	Local	100/56	100/62	Very good	None	Reacted 2½ hours, postoperatively
Closed reduction of left femur, spica	170	50	3	10	Magendie solution m vii	None	128/84	114/84	Very good	None	Reacted quietly 1 hour postoperatively
Closed reduction, left femur	160	76	2	11	Magendie solution m vii	None	122/60	112/66	Satisfactory	None	Opened eyes, talked postoperatively No complaints 9 hours postoperatively
Incision and drainage of rectal abscess	31	3	0 6	3	None	$C_2H_4 + O_2$	112/70	90/72	Satisfactory	None	Pulse 152 preoperatively Pulse 144 postoperatively Reacted 1½ hours
Encephalgraphy*	36½	6	0 7	3	None	None	100/72	92/68	Very good	None	

* Operation to determine nature of lesion causing Jacksonian convulsions, duration 2 hours, 20 minutes Anesthesia did not appear to affect normal reaction when spinal fluid was withdrawn and air injected That is, after 20 c c of spinal fluid had been withdrawn and 20 c c air injected, the pulse volume would fall off with each succeeding 5 c c withdrawal, but volume promptly returned following 5 minutes pause 60 c c spinal fluid removed Reacted 3 hours postoperatively, somewhat restless

CITY HOSPITAL, WELFARE ISLAND, NEW YORK CITY*

Operation	Weight	Age	Amount Rectal Evipal Soluble, Gm	Sleeping after Evipal, Min	Supplemental Medication	Terminal Anesthetic	Blood Pressure		Relaxation	Postoperative Nausea	Remarks
							Preoperative	Postoperative			
Thoracotomy	130?	36	3	6	Dilaudid gr 1/24	Local	100/62	90/48	Very good	None	Reacted quietly 2½ hours postoperatively
Rectal fistulectomy	128	35	2	8	Dilaudid gr 1/24	N_2O	128/80	120/80	Very good	Vomited twice	Reacted quietly, six hours
Thoracotomy	120?	40	2	4	Dilaudid gr 1/24	Local Ethylene and O_2	140/100	120/74	Very good	None	Reacted 4½ hours, restless
Exploratory laparotomy for carcinoma of gastro-intestinal tract	126½	60	2	6	Dilaudid gr 1/48	Ethylene and O_2	108/70	102/60	Very good	None	Reacted 11 hours? restless
April, 1936											
Cholecystectomy	144½	44	2½	5	Dilaudid gr. 1/24	Ethylene and O_2 + small amount ether	128/80	120/70	Excellent	None	Reacted quietly, 4 hours Previous operation under ether was nauseated High praise for evipal
Mastoidectomy	92	15	1	12	Dilaudid gr 1/96	$N_2O + O_2$	110/40	116/34	Very good	None	Reacted quietly, 3 hours post operatively
Cholecystectomy—Left inguinal herniorrhaphy	126	55	2	8	Dilaudid gr 1/24	$N_2O + O_2$ small amount ether vapor	118/70	120/76	Very good	None	Reacted 50 minutes postoperatively, restless
Intestinal resection	119	36	2	6	Morphine sulphate gr ¼ Dilaudid gr 1/96	Ethylene + O_2	128/80	140/80 (Infusion)	Excellent	Vomited once	Infusion during operation Duration 2½ hours Reacted quietly, 4 hours
Mastoidectomy bilateral	30	6	5/10	2	Morphine sulphate gr 1/12	Ethylene O_2 (Skin incision and closure)	100/60	90/50	Very good	None	Reacted quietly 15 minutes post operatively Child very ill Preoperative temperature 104°, pulse, 140, R, 36 Recovering from pneumonia
Cauterization of granuloma of lips	120	33	2½	6	Dilaudid gr 1/24	None	112/70	90/60	Excellent	None	Reacted 7 hours postoperatively, restless
Gastroenterostomy for carcinoma	115	68	1	12	Dilaudid gr 1/24	Ethylene and O_2 + small amount ether	110/60	100/60	Very good	None	Reacted 5½ hours, somewhat restless
Rib resection for empyema	30	6	5/10	5	Dilaudid gr 1/96	Ethylene and O_2	90/40	90/50	Fair	None	Child extremely ill Operated 7 days previously for bilateral mastoid Reacted in operating room
Herniorrhaphy	138	38	2½	6	Dilaudid gr 1/24	Ethylene and O_2	138/80	140/70	Very good	None	Reacted quietly, 2½ hours postoperatively

* Charts by E R Plumb, Anesthetist.

catheter and wait until the patient is asleep, which usually takes about five minutes.

Over 80 per cent of all surgeons give some form of preanesthetic medication. It should be more generally known than it is, that psychic influences are not destroyed by 1/8, 1/6 or 1/4 grain of morphine alone since the systolic blood pressure with this medication often goes up 40 mm. to 90 mm. just prior to the administration of the anesthetic on the table.[10] Wallace and Gwathmey proved in the laboratory that with preanesthetic medication complete anesthesia is obtained with 87 c.c. of ether solution given intravenously in 6 per cent normal saline as compared to 134 c.c. when preanesthetic medication is omitted. They also showed that to produce respiratory failure 245 c.c. of ether solution with preanesthetic medication was required, whereas only 99 c.c. caused such failure when no preanesthetic medication was used. Hooper and Gwathmey[11] demonstrated in the laboratory that with any of the customary inhalation anesthetics the animals which had received preanesthetic medication survived over twice as long as the others which had not been treated in this manner. All of the animals received the same amount of the anesthetic. Furthermore, it was shown at necropsy that lung lesions occur in animals not subjected to preanesthetic medication. Gross examination disclosed distention, edema and congestion; microscopically, perivascular edema, diffused petechia, alveolar spaces filled with fluid and bronchi filled with edematous fluid. The lungs of the animals receiving preanesthetic medication were relatively normal.

SUMMARY

1. Since using dilaudid there has been no occurrence of nausea and vomiting, as compared to 16 per cent of the patients who were nauseated when morphine hydrochloride was used.

2. The index of 0.2 c.c. per pound body weighed holds good for all ages. The youngest patient was three years of age, and weighed thirty pounds, received 6 c.c. of a 10 per cent solution of evipal soluble, which was entirely satisfactory. The oldest patient who was eighty-five years of age and weighed 150 pounds, received 3 gm. or 30 c.c. of a 10 per cent solution.

3. Rectal evipal soluble given in the patient's own bed abolishes mental fear as well as physical pain.

4. Both laboratory and clinical experience demonstrate the value of safe preanesthetic medication. Rectal administration of evipal soluble in the dosage stated makes inhalation, local or spinal anesthesia safer for the patient and easier for the surgeon. Evipal soluble may be given rectally in cases in which intravenous anesthesia is contraindicated because of the fear aroused in nervous patients or the difficulty encountered in entering a vein as in children and obese individuals.

REFERENCES

1. Weese, H. *Deutsche med. Wchnschr.*, 58: 1205–1207, 1932; 59: 47, 1933; *Fortschr. d. Therap.*, 8: 487, 1934.
2. MacMahon, J. S. and MacMahon, E. G. A Report on Thirty Cases of "Evipan Sodium" Anaesthesia. *Med. Jour. Australia*, 1: 690 (May 26) 1934.
3. Killian, Hans. The new German evipan-sodium anesthesia. *Current Res. Anesth. and Anal.*, 13: 177–183, 227–232, 1934.
4. Report of Anesthetic Committee of Medical Research Council. *Lancet*, 5731: 43, 1933.
5. Jarman, R. *Proc. Royal Soc. of Med.*, 28: 341–346 (Jan.) 1935.
6. Jackson, D. E. *J. Lab. and Clin Med.*, 20: 3, 1934.
7. Wood, Paul M. Coramine in denarcotization and resuscitation. *Am. Jour. Surg.*, 22: 86–91 (Oct.) 1933.
8. Livingston, Ed. M., Emy, Sabro and Lieber, Hyman. Evipal sodium, a short intravenous anesthesia. *Am. Jour. Surg.*, 26: 516–521 (Dec.) 1934, No. 3.
 Lundy, J. S. and Tovell, Ralph M. The technique of nerve blocking for various orthopedic operations. *Brit. Jour. Anesth.*, 12: 52 (Jan.) 1935.
 Suraci, X. Charles. Evipal soluble, a unique anesthetic for intravenous use *Med. Ann. District of Columbia*, 4: 29 (Feb.) 1935.
 White, Chas., Collins, L. and Lloyd, J. Evipal anesthesia, a preliminary report. *Am. Jour. Surg.*, 25: 131 (July) 1934.
9. Gwathmey, J. T. The open method of nitrous oxid-oxygen anesthesia. *Am. Jour. Surg.*, Oct., 1920.
10. Coburn, R. C. Blood pressure in operative surgery and general anesthesia. *J.A.M.A.*, 82: 1748 (May 31) 1924.
11. Nelson's Loose Leaf Surgery, vol. 9, opposite page 14.

ELECTROSURGICAL OBLITERATION OF GALL BLADDER WITHOUT DRAINAGE

AS A MEANS OF REDUCING MORTALITY*

(Report of 201 consecutive unselected cases)

MAX THOREK, M.D.,

Professor of Surgery, Cook County Graduate School of Medicine, Surgeon-in-Chief, American Hospital of Chicago, Attending Surgeon, Cook County Hospital, Consulting Surgeon, Municipal Tuberculosis Sanitarium, etc.

CHICAGO, ILL.

AN unbiased survey of the literature shows that in selected, uncomplicated cases the removal of the gall bladder with the scalpel yields a mortality of 1 or 2 per cent and in the hands of those not especially trained, particularly in patients over forty years of age with coexistent hepatic and cardiorenal disease, the mortality is 10 per cent or even higher. This holds as true today as it did a few decades ago. In 1923, Enderlen and Hotz[1] collected 12,144 cases from leading clinics throughout the world and showed a global mortality of 9.28 per cent. Verbrycke[2] quoting Lyons, stated that in the Garfield Memorial Hospital,

TABLE I

MORTALITY STATISTICS IN GALL-BLADDER OPERATIONS FROM 1908–1932

Surgeon	Number of Cases	Year Mortality	Per Cent
1. Cotte, M.	Not given	1908 Males	33
		Females	18
2. Davis, B. B.	563	1921	8.17
3. Enderlen and Hotz	12,144	1923	9.28
4. Brentano	280	1923 Males	36.78
		Females	17.29
5. Villard	131 cholecystostomies	1925 Males	34
		Females	21
6. Duclos	Global mortality	1926 Males	36
		Females	23
7. Boutin	18 cases complicated by perforation	1927 Males	71.43
		Females	27.21
8. Davis, B. B.	160 cases	1928	3.75
9. Cattell, R. B. *Ann. Surg.* 89: 932 (June) 1929	311 cases (complications, 55 cases)	1929 Males	9.1
		Females	6.8
10. Sanders, R. L. *Ann. Surg.* 92: 374 (Sept.) 1930	18 series of cases garnered from the literature totaling 60 cases	1930	15
11. Verbrycke	169 patients operated by 23 surgeons; 1 surgeon in this series had 10 cases; another surgeon in this series had 20 cases.	1927	8.8
			28.5
			15
12. Tixier, Clavel and Chabannes	11 males	1932 Males	36.38
	149 females	Females	16
13. Thorek	649 cases	1910	
	138 males	to Males	16.8
	511 females	1932 Females	9.4

* From the author's surgical services at the Cook County and American Hospitals and Cook County Graduate School of Medicine, Chicago, Ill.

Washington, D.C., the mortality for biliary surgery by individual operators over a period of two years varied from 1 to 28



Fig 1. Bile ducts in the gall-bladder bed, magnified 19 times

per cent. Mortality advances rapidly with age, in the sixth and seventh decades being more than double that of the fourth decade. It is much greater in males than in females. This is explained by Tixier on an anatomic basis, a narrow configuration of the lower male thorax and consequent inaccessibility of the structures. The subjoined Table 1 furnishes information on the status of mortality at various clinics from 1908 to 1932, inclusive.

It is improper to judge the brilliant results obtained by a few exceptional operators. One must take into cognizance the general results of the average surgeon who does not often report his cases. In view of the aforesaid, one cannot escape the conviction that in many instances an immediate operative mortality may be recorded as high as 20 or 30 per cent or even higher, depending upon the nature of the case and other factors.

What invites fatalities following classical cholecystectomy?

1. In 15 to 25 per cent of individuals there are enlarged bile capillaries and even large sized bile ducts running in the gall-bladder bed (Figs. 1, 2). A removal of the gall bladder with the cold scalpel necessarily opens these bile passages and bile leakage results.

2. Bile, whether sterile or not, has proved to act as a true chemical poison in the peritoneal cavity. Bakeŝ[3] observed bile issuing from the wound 230 times in 346 cases of simple cholecystectomy. He and many other surgeons were impressed by the postoperative appearance of bile in the dressing "in nearly all the cases."

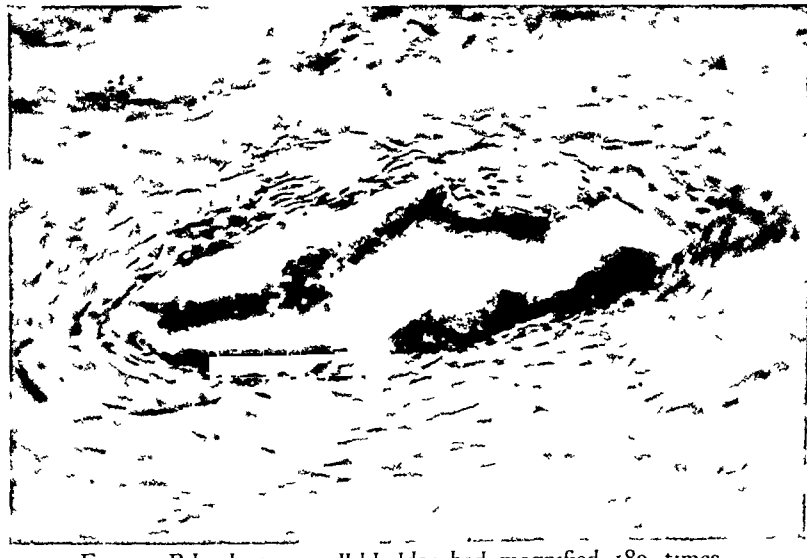


Fig 2. Bile duct in gall-bladder bed magnified 180 times

In view of the fact that bile leakage should never occur from a properly ligated cystic duct, it stands to reason that the

unprotected, discharging gall-bladder bed plays the important role in this connection.

3. Furthermore, after classical cholecystectomy the gall-bladder bed cannot always be obliterated by sutures, the resulting raw, rather large open surface is often responsible for bile leakage. Under these conditions resort is made to drainage, but this invites leakage.



Fig. 3. Electrocoagulated gall bladder consisting of a hyaline-like network of inert tissue.

4. The evil effects of drainage are too well known to require discussion other than to mention a few, viz.: augmentation of bile seepage; possibility of thrombosis and embolism; hemorrhage from erosion of vessels; cholemic bleeding and embarrassed cardiac action, particularly in the aged; pneumonia; acute dilatation of the stomach; biliary fistulas, etc. To put it differently many patients die following gall-bladder operations not because they were not drained, but because of drainage. And while the profession is still too much under the thralldom of Kehr's famous dictum that "proper drainage is half a successful gall-bladder operation" it appears, nevertheless, in the light of recent observations, that drainage might also be considered as half an unsuccessful operation.[4] While many of the dangers are eliminated by omitting drains, yet in classical cholecystectomy a drain is often the lesser of two evils and may be the means of saving a life. No less an authority than Lord Moynihan speaks of a "conscience drain," when discussing drainage in this connection.

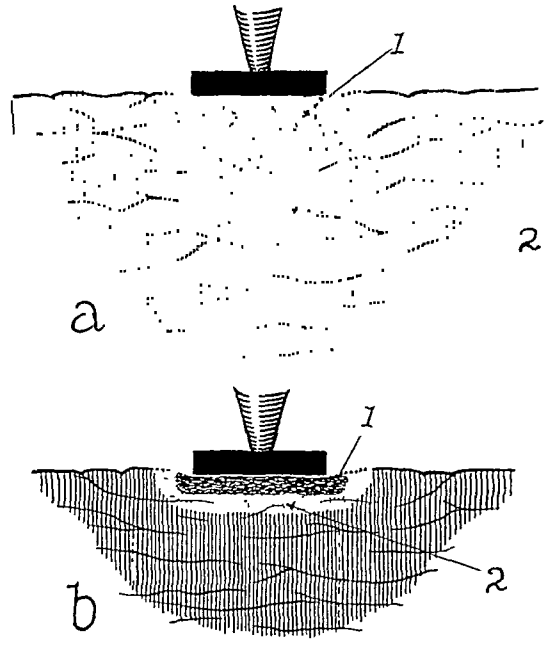


Fig. 4. Diagram of effects of electrocoagulation and of carbonization. In *a* one observes the degree and extent of electrocoagulation when correct technic is used. The dense area immediately under the electrode indicates that here the action is of greatest intensity. It gradually decreases as indicated in the diagram. Marginal action is seen to extend for some distance from the border of the electrode. When improperly used and too much current is applied charring results immediately under the electrode *b*. Such eschar insulates the area acted upon and further effects of coagulation are frustrated.

How can the evils of drainage be avoided?

Experimental studies for a number of years have convinced me that if one could substitute a dry, non-leaking surface instead of a discharging cavity as the gall-bladder bed represents following cholecystectomy, it would be a great step in the right direction. This thought has been brought to fruition by electrocoagulation. It has been shown that electrosurgical

coagulation, properly performed, converts the tissues into a hyaline-like, dry, aseptic, inert tampon. (Fig. 3.) We must emphasize



Fig. 5. Effects of electrocoagulation on liver tissue (after Kuntzen and Vogel). First Division: *a*. zone of vacuolation; *b*. zone of palisade cells; *c*. primary zone of necrosis; *d*. primary zone of demarcation. Second Division: *a*. secondary zone of necrosis; *b*. secondary zone of demarcation.

that in order to understand the thesis here presented it is important to have a clear picture of and to understand the differences between *fulguration, carbonization* and *coagulation,* terms often used promiscuously and not well understood.

The following throws some light on the genealogy of the terminology under discussion. Monopolar sparking from a high frequency transformer (of Tesla, D'Arsonval, Oudin) was termed sideration by Keating-Hart and electrodissection by Clark and later fulguration by Pozzi. Nagelschmidt introduced the now accepted term diathermy. Bipolar diathermy for surgical purposes was first called voltaiza-



Fig. 6. Electrocoagulation of surface of liver with graft of falciform ligament. Brindle bulldog. Specimen removed seven weeks after operation. An area the circumference of a nickel was electrocoagulated to a depth of about 2 cm. A freely detached portion of the falciform ligament was sutured over it. Note firm union of falciform ligament to electrocoagulated surface of liver. Arrow points to area described.

tion bipolaire and later electrocoagulation by Doyen. Delherme and Laquerriére spoke of endothermy showing that the heat is produced in the patient's body. George Wyeth in 1926, simplified the terminology by coining the terms medical and surgical diathermy. Hanschen speaks of exsiccation, charring, Heitz-Boyer of étincelage á l'intensité, Cushing of dehydration, Kowarchik of electrotomy, von Seemen of "Schmelzschnitt," etc.

To avoid confusion, let it be recalled that if a flat electrode of bipolar current is firmly applied to a tissue surface and a current of proper voltage and sufficient amperage is permitted to pass through it, dehydration and coagulation of the tissue proteins results in a few seconds. This is manifested by the white color assumed by the tissue thus treated. This is called electrocoagulation. On the other hand, if this same electrode is not applied firmly or if used as a unipolar or even bipolar instrument, a small air space, (dielectricum) intervenes between the electrode and tissue

and sparking, fulguration, and carbonization with black discoloration of the tissues results. A reapplication of the electrode to



Fig. 7. Mesentery of guinea pig. Electrocoagulation with small ball-electrode along course of mesenteric vessels followed by subserous injection of India ink of the lymph vessels of the mesentery and wall of bowel. Arrow points to spot of coagulation followed by complete interruption of lymph vessels and spindle shaped narrowing and closure of blood vessels. Note that adjacent lymph vessels not touched by the electrode, remained unaffected. (Zschau.)

such fulgurated or carbonized surface will stop further current penetration and prevent coagulation from taking place (Fig. 4). Also, in cauterization the heat is brought to the tissues from the outside by the heated instrument, while in bipolar electrocoagulation the heat is produced in the patient's body, 75,000 to 3,000,000 or more oscillations per second depending upon the type of apparatus used, (short wave).

Definite tissue changes take place when, for example, the liver is subjected to the electrocoagulating bipolar current. This problem has been solved jointly by Kuntzen and Vogel. The legend of

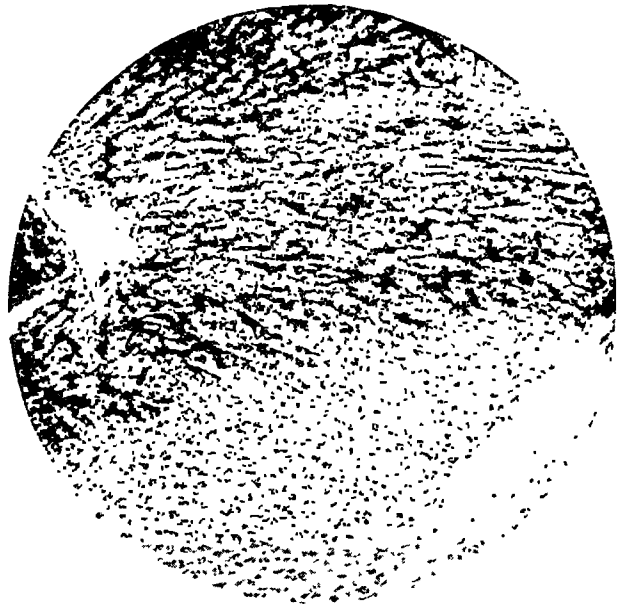


Fig. 8. Liver of guinea pig. Observe line of demarcation between coagulated zone, or coagulating cut, and zone in which blood capillaries are filled with India ink. The blood capillaries remained empty for a distance of 3 mm. Here also the closure of the blood capillaries as in the case of the lymph capillaries is effected not by thrombosis but by coalescence, or coagulation, and junction of the vessel wall. (Zschau.)

Figure 5 briefly describes these changes. It must be stressed that electrocoagulated surfaces within the abdomen do not slough as do surfaces on the exterior of the body where they are eliminated by extrusion. In other words, electrocoagulated tissues on the surface are thrown off, or extruded, while within the abdomen they become encapsulated and are absorbed. Furthermore, electrocoagulated surfaces on parenchymatous organs develop an affinity, a positive chemiotaxis, for serous surfaces attracting contiguous organs covered with serosa, as the bowels, stomach, etc. I have observed agglutination three hours after electrocoagulating the surface of the liver. Firm union takes place in a comparatively short time (Fig. 6).

The capillaries and blood vessels of an electrocoagulated area do not thrombose but a recession of the column of blood

ensues within the vessel, above and below the point of contact of the electrode and the vessel walls coalesce with the con-

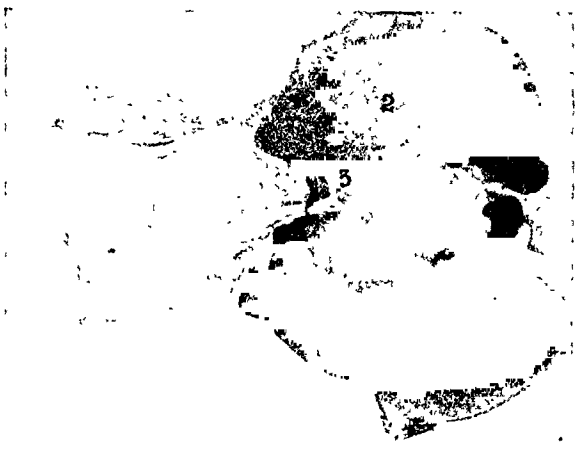


Fig. 9. Results of cholecystelectrocoagulectomy with falciform ligament implantation in a police dog. Specimen removed seven weeks after operation: (1) falciform ligament; (2) lobe of liver; (3) gall-bladder bed; (4) ligated cystic duct and artery. Fine adhesions between falciform ligament and gall-bladder bed; firm union of lower end of falciform ligament with stump of ligated cystic duct.

tiguous homogenous, hyaline-like structures mentioned (Figs. 7, 8). Such changes do not take place with fulguration or carbonization. Or as Ellis[5] says, "Hemostasis as a result of diathermy does not take place by thrombosis but by collapse and fusion of the walls of the vessels." Aschoff demonstrated that coagulation thrombosis is in sharp contradistinction to true thrombus formation.

Another important fact in electrocoagulated tissues as related here is that in the gall-bladder bed secondary hemorrhage does not occur because of the pressure exerted by the sequestrated, coagulated mass against the contiguous tissue.

It will thus be seen that properly executed *bipolar electrocoagulation* substitutes a secure sterile tampon for an insecure open cavity at the site of the gall-bladder bed.

Evolution of the Author's Method

For some years the experimental animals used in this series of investigations were large dogs, macacus rhesus and macacus leoninus[6,7] and portions of freshly removed gall-bladders at operation. It must be recalled that the absence of pathology in

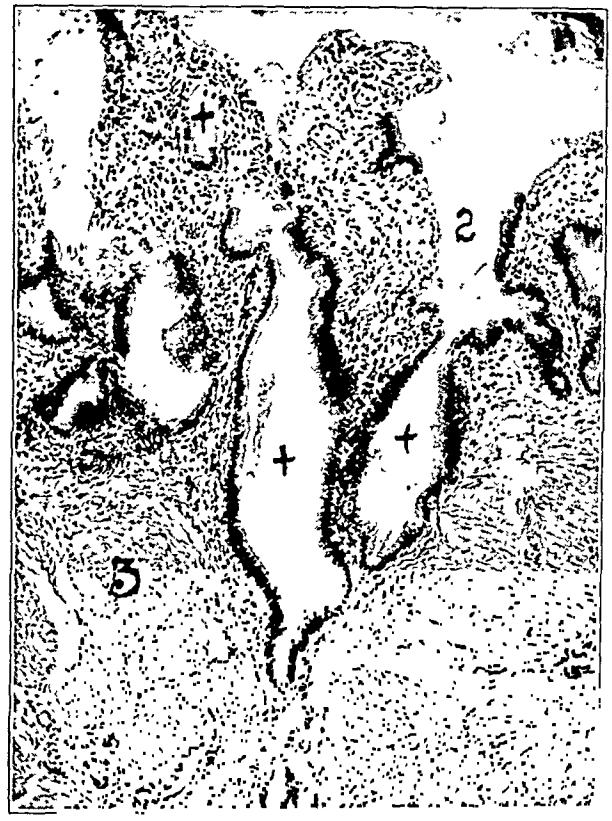


Fig. 10. Chronic cholecystitis, (1) mucosa, (2) Rokitansky-Aschoff sinuses, (3) muscularis.

animals as well as anatomic differences, (viz., size and configuration) renders experimentation difficult and at best deductional. Nevertheless, experimental studies have to be done on lower animals before any given method can be tried on humans.

The results of my experimental studies permitted the following conclusions:

1. The posterior gall-bladder wall and bed of the gall bladder may be effectually electrocoagulated and their structure converted into an inert, dehydrated, hyaline-like, aseptic tissue.

2. Electrocoagulated borders of the gall bladder may be approximated with sutures.

3. The ligamentum falciforme hepatis may be completely detached and when superimposed over an electrocoagulated surface will become intimately united with it (Fig. 9).

4. The abdomen may be closed without drainage provided the cystic duct is securely ligated and the cystic artery



Fig. 11. Effects of carbonization on gall bladder with chronic inflammation. Observe portion of Rokitansky-Aschoff sinus, right, persisting. Entire muscularis and serosa unaffected. Large vessel at bottom of section markedly engorged.



Fig. 12. Effects of forced carbonization on wall of inflamed gall bladder; (1) eschar, (2) Rokitansky-Aschoff sinus in transverse section, (3) muscularis and (4) serosa. Note excellent state of preservation of layers of gall bladder past the mucosa.

closed by double ligation.

In 1928, E. H. Trowbridge[9] described electrosurgical cholecystectomy with recovery, and E. Heymann[10] speaking before the Berlin Medical Society in May, 1930, stated that for sometime past he has removed gall bladders by dissecting the gall bladder from its bed as in the classical procedure with the diatherm knife instead of the scalpel and that for some years past he removed also the appendix, portions of the stomach, etc., by the same means.

About the same period a number of others, Keysser et al. and Mirizzi reported that they had performed electrosurgical cholecystectomy with the diatherm knife instead of the scalpel. Drainage was used. It is obvious that the methods these observers resorted to were in no way different from classical cholecystectomy except in substituting the cutting electric current instead of the scalpel, therefore, leaving the gall-bladder bed unprotected. The results were about the same as in classical cholecystectomy.

Stimulated by surgeons who for many years preceded him with the use of the hot iron, in 1928, Pribram[11] used carbonization, at first with the Paquelin burner and a year later with the diatherm apparatus. His object was "carbonization" of the mucous membrane of the gall bladder, this he termed "*mucoclasis.*" *He aimed* at "burning, charring and carbonization" and not at coagulation. *In* 1933[12] and even as recently as 1934, Pribram still speaks

of "carbonization." He says "Originally, I used the Paquelin burner to destroy the mucous membrane. This proving ineffective, I used Hadenfeld's hot iron such as is used in Bier's clinics. The burning effect was excellent. In spite of this it did not meet with the desired effects, because: first, the heat introduced into the abdomen was too great; second, the danger of explosion." He then describes a diatherm apparatus designed by Keysser. It is significant that while working with fulguration, Pribram continues to speak of "charring" and "carbonization." He says: "One must not approximate the electrode snugly. One must just barely touch it, and when sparking results, the mucous membrane will be destroyed promptly. Avoid deep penetration."

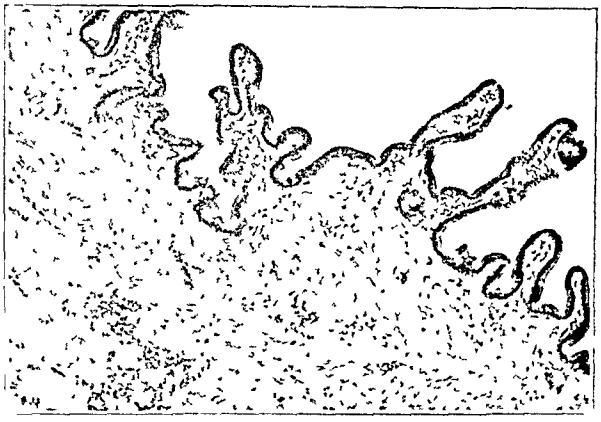


Fig. 13. Reason for failure of mucolasis. Mrs. M. L. Chronic cholecystitis nine months after electrocarbonization of mucous membrane of gall bladder (mucoclasis). No relief of symptoms. Regeneration of mucous membrane and persistence of inflammation (round cell infiltration, and the like). Relieved by electrocoagulation of entire gall-bladder wall. Reduced from a photomicrograph.

It will thus be seen that Pribram's mucoclasis is a fulguration method aiming solely at destruction of the mucous membrane of the gall bladder. It is self evident that this is ineffective to eradicate gall-bladder disease because the charred area prevents the current from reaching the depths of the affected zone in the gall-bladder wall, viz: the Rokitansky-Aschoff sinuses (Luschka's glands) which harbor infection. (Figs. 10, 11 and 12.) Besides it has been shown by Schmiedheiny[13] and others that gall-bladder infections often transgress all layers of the gall-bladder wall, the gall-bladder bed and extend to various depths into the liver substance. The futility of simple fulguration of the mucosa of the gall bladder in such cases even when extensive is obvious.

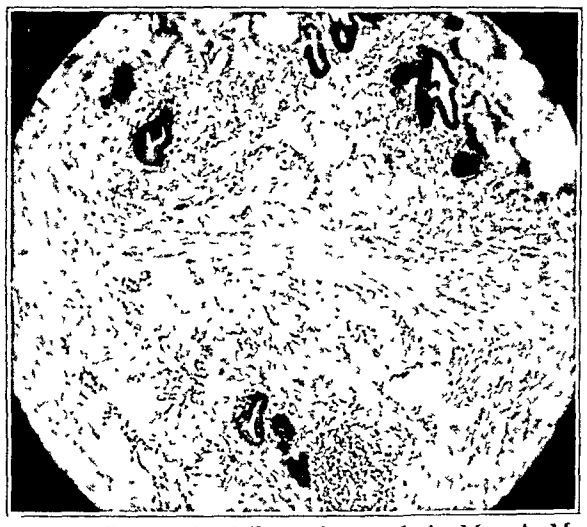


Fig. 14. Reason for failure of mucoclasis. Mrs. A. M. Chronic cholecystitis eight months after (mucoclasis) electrocarbonization of the mucosa. Note remnants of Rokitansky-Aschoff sinuses and diffuse round cell infiltration. Below in center of field, an aggregation of polymorphonuclear leukocytes. Reduced from a photomicrograph with a magnification of 105 diameters. Persistence of symptoms. Relieved by total obliteration of gall-bladder wall by electrocoagulation.

In view of the good results reported by Pribram, I used his method on a number of patients. After some time, I found that patients thus operated were not relieved of their symptoms and presented themselves for reoperation. At such interventions the opportunity was offered to see what transpired following the use of the Pribram method with fulguration with both cautery and diathermy. There was regeneration of the mucous membrane of the gall-bladder mucosa and the diseased layers of the gall bladder were little or not affected at all. The infection persisted. (Figs. 13 and 14.) It appeared to me at that time that if the entire gall-bladder wall could be destroyed a further step in

the right direction could be taken, and this was proved, as will be shown. Later, Albertin[14] has shown that Pribram lost that he lost 3 of 16 patients, a mortality of 18.75 per cent. Also, Whitaker's disregard of the important conclusions of

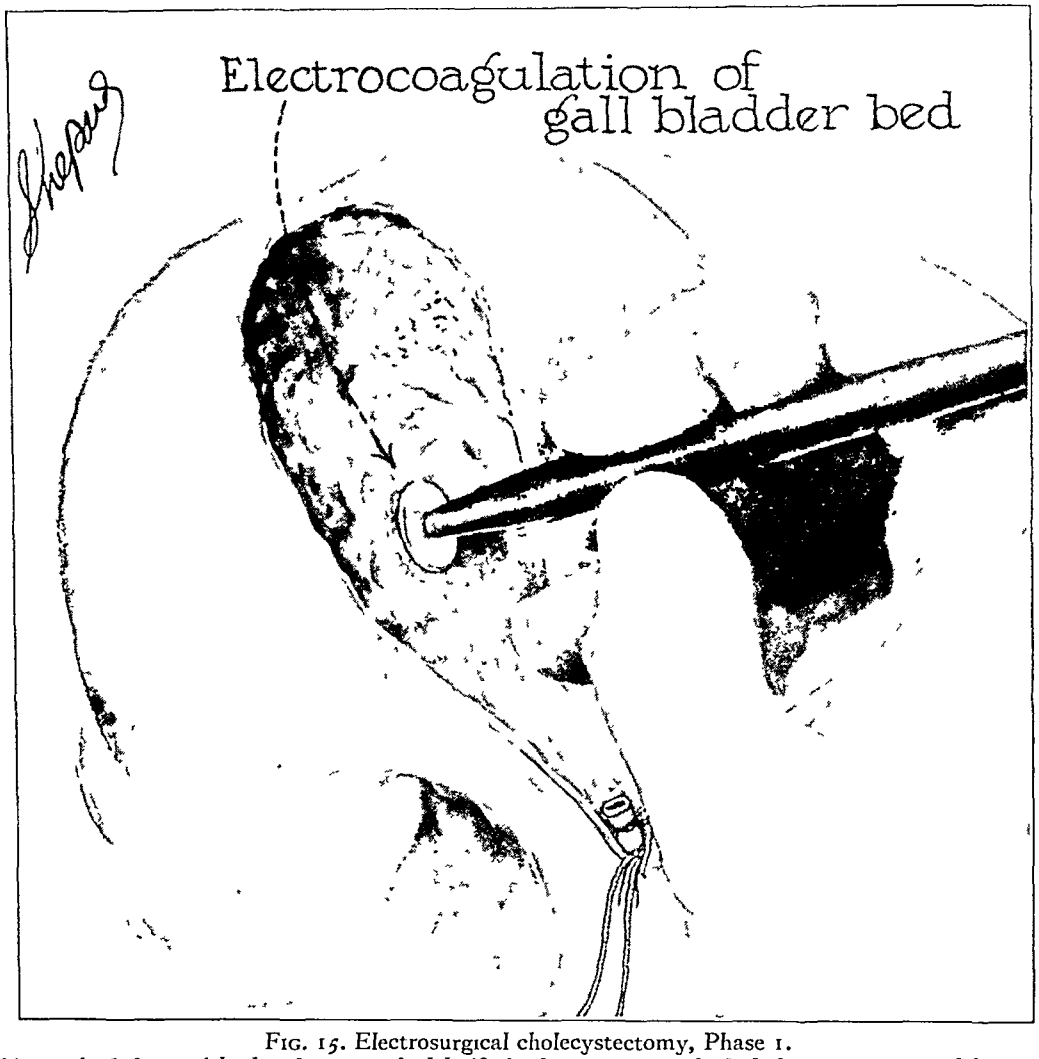


Fig. 15. Electrosurgical cholecystectomy, Phase 1.

This method done with the electrosurgical knife is the same as scalpel cholecystectomy and *has not yielded any better results than classical method.* If accompanied with drainage the results are much worse than classical cholecystectomy, (see Whitaker's results) and therefore should not be used.

9 patients in a series of 310 cases in which he used his method of mucoclasis.

Others attempted to use a combination of methods with disappointing results. In 1930, some years after Trowbridge, Heymann and Pribram reported their methods of electrosurgical cholecystectomy and gave them a trial, L. S. Whitaker[15] also used the cutting current in removing the gall bladder. Later, he[16] disregarded the admonition of Pribram and drained his patients thus treated with the result such eminent workers as Pribram, Wyeth, Cushing, Clark, Heitz-Boyer, v. Seemens, Doyen, Pauchet, Ward, Kelly, Zschau, Kuntzen, Keysser, Vogel and a host of others on the effects of the different currents to which Whitaker refers as "hair-splitting," contributed greatly to his discouraging results. (Figs. 15 and 16.)

Based on my researches and clinical studies a procedure was evolved, the underlying principles of which consist of: (1) biterminal electrosurgical obliteration of

the posterior gall-bladder wall and bed by electrocoagulation; thus substituting a sterile, dehydrated tampon for a bleeding, gall-bladder pathology. There was one death (Case No. 149). Postmortem examination showed that the patient died

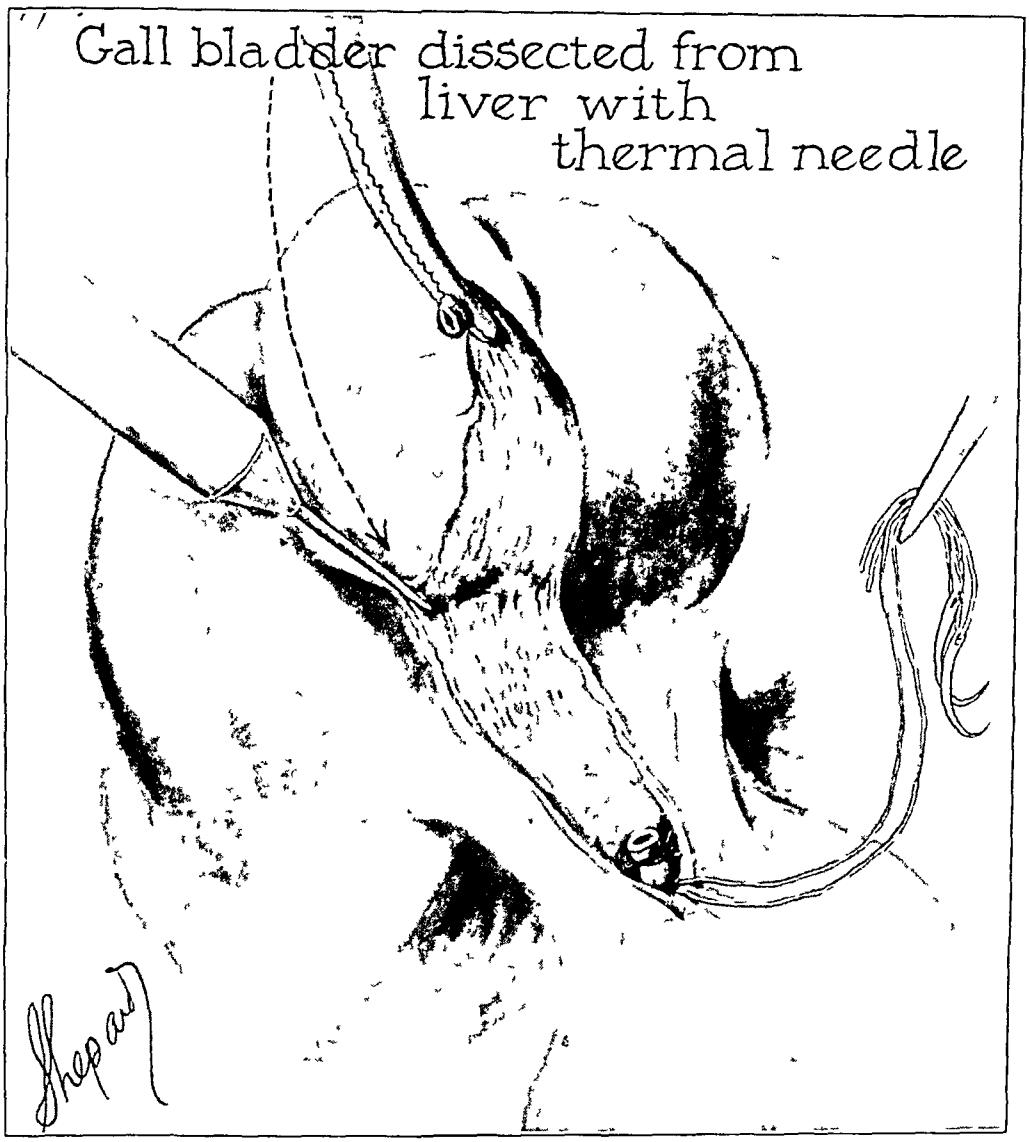


Fig. 16. Electrosurgical cholecystectomy, Phase 2, *not recommended.*

bile leaking surface; (2) the great tendency of electrocoagulated surfaces to become agglutinated with serous surfaces caused me to muster the falciform ligament into service; (3) strict avoidance of drainage.

Up to the present writing, April, 1936, I have performed this operation, termed "cholecystelectrocoagulectomy," in 181 consecutive, unselected cases of gall-bladder disease including gangrenous, empyematous, sclerosed and other forms of from causes unrelated to the operation (Table II). In a personal communication dated Dec. 31, 1935, from Kellogg of the New York Post-Graduate Hospital he states that he used my method in 16 cases without a death, while Finlayson operated on 4 patients with good results. This brings the total operations performed to 201 cases.

Whether my procedure alone or the painstaking pre- and postoperative care of patients or both contributed to these

results, I am unable to say. Yet, I am fully cognizant of the occasional occurrence of a so-called "liver death" following classical cholecystectomy.

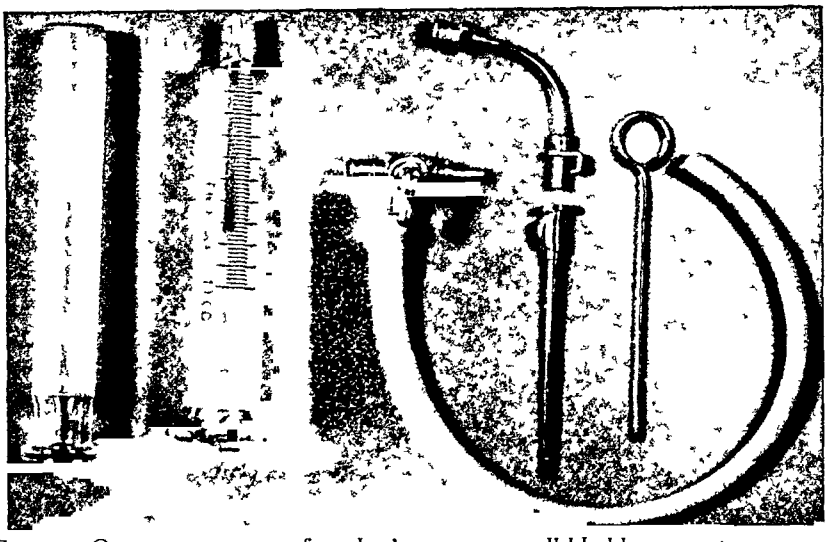


Fig. 17. Component parts of author's two-way gall-bladder aspirating syringe.

TECHNIC

Thorough preoperative preparation of the patient is a imperative.

Step 1. Wherever possible subarachnoid block is the anesthetic of choice, otherwise inhalation anesthesia is chosen. The patient is placed in the Mayo-Robson position with the lower thorax and upper abdomen sufficiently elevated. A large, flat, indifferent electrode is snugly applied over the sacrum. Preferably a simple, median longitudinal pararectus incision is made beginning at the xiphoid and extending to about the level of the umbilicus. Exposure must be thorough.

Step 2. Mobilization of the falciform ligament. This structure is completely detached from its moorings to the anterior abdominal wall with the exception that it is permitted to remain attached temporarily by a narrow pedicle and is packed out of the way by warm laparatomy sponges. In detaching the falciform ligament from the anterior abdominal wall, some small vessels are severed; these must be carefully ligated. Pack the viscera out of the way and obtain good exposure by efficient retraction.

Step 3. The biliary passages are explored and the gall bladder is aspirated, using an especially designed aspirator (Figs. 17 and 18) which permits evacuation of the gall-bladder contents into a receptacle via a rubber tube. After aspirating its contents, the gall bladder is filled with hexylresorcinol (S.T. 37) or 3 per cent iodine solution. Only about 5 per cent of bile contains microorganisms while their presence in the gall-bladder walls may be demonstrated in over 70 per cent of cases. For that reason I introduce an antiseptic into the gall bladder before opening it.

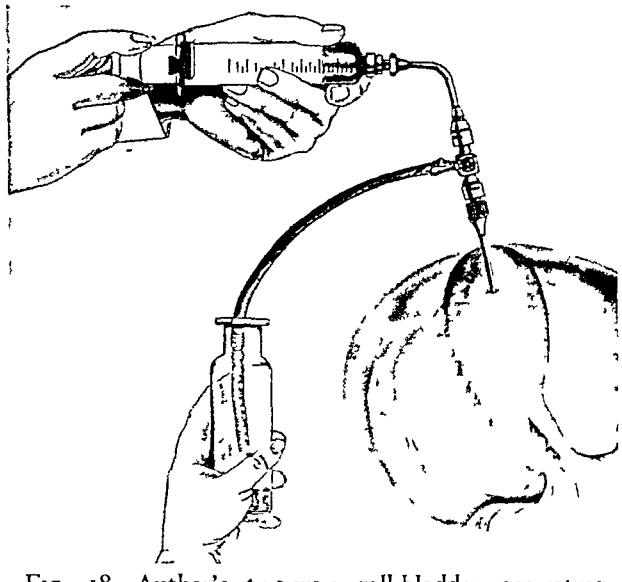


Fig 18 Author's two-way gall-bladder aspirating syringe in use

The extrahepatic biliary passages are explored next. The cystic artery and duct are ligated doubly and jointly, cutting

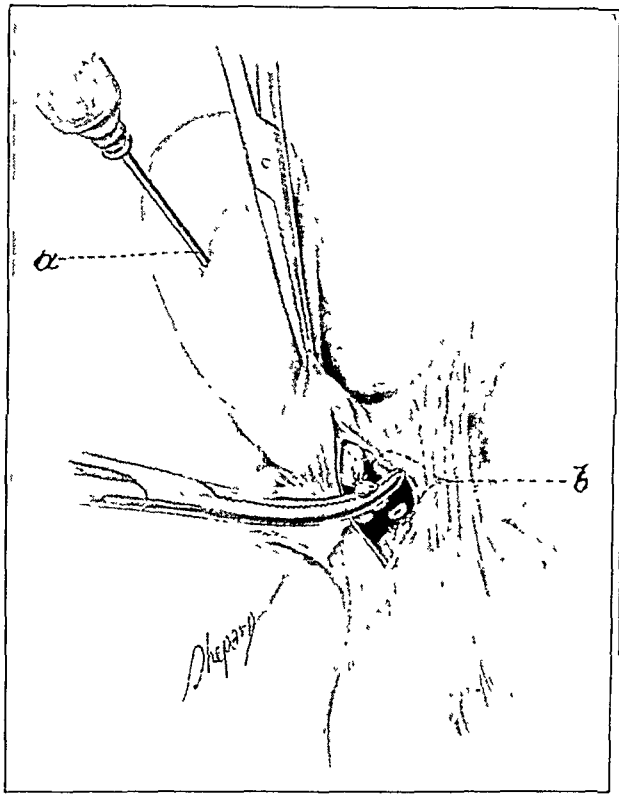


Fig. 19. Aspiration of the gall-bladder; cystic duct and artery have been doubly ligated. The ligatures are cut short.

both ligatures short. (Figs. 19, 20 and 21.) Experience has taught me not to attempt extensive dissections in searching for the cystic artery if it is not easily isolated, but to splint it with the ligature to the cystic duct. This should be followed particularly in inflammation about the hepatoduodenal ligament. The frequent, abnormal course of the artery should be kept in mind.[17]

Step 4. Open the gall bladder and evacuate its contents. A non-spilling gall-bladder content receptacle[18] (Fig. 22) collects the evacuated material without spilling it. Old fashioned gall-bladder spoons are too shallow and offer no protection against contamination from spilled contents. My instrument consists of a cone shaped container measuring 2¼ inches in diameter and 2 inches in depth, mounted on a shaft of suitable size. A close fitting cover is hinged and held open when in use by means of spring friction

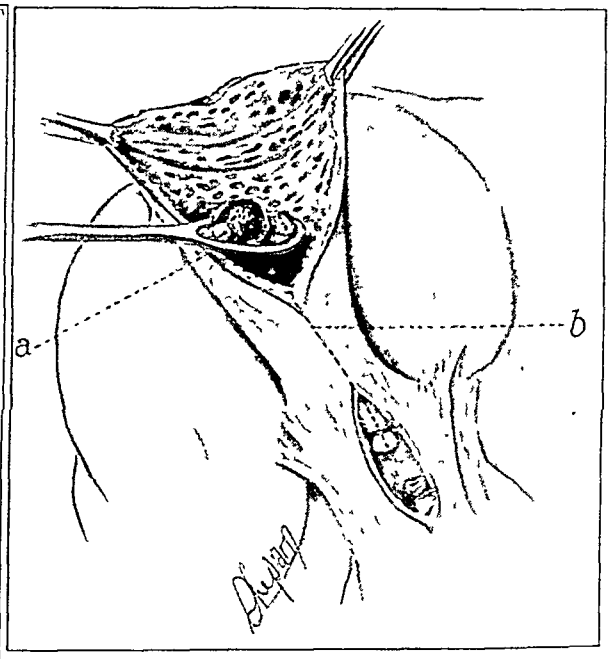


Fig. 20. Gall bladder is opened along its entire length with an ordinary pair of scissors. Electric cutting scissors have been discarded by the author after having proved ineffective. The gall bladder is cleared of its contents.

clips. Slight pressure upon the cover releases it so that the material cannot spill during its removal. The front part of the receptacle is somewhat concave allowing sufficient latitude for proper contact with the subcholecystic structures, and its edges rodded, thus avoiding injury to the liver.

Step 5. Split the gall bladder longitudinally from above downward with an ordinary pair of scissors. Grasp half of the gall-bladder wall with an insulated angiotryptic forceps* (Figs. 23*a* and *b*). In closing the forceps, the gall-bladder wall is crushed and the blood vessels coursing in it are reduced by compression to a mere ribbon (Fig. 24). With a pair of scissors remove the redundant portion of the gall-bladder wall. Tuck a piece of rubber around the angiotryptic forceps holding in its grasp the remaining gall-bladder edge. Apply an electrode (see insert in Fig. 24)

* An ordinary artery forceps sheathed in rubber tubing will act just as well.

along the exposed margin of the gall bladder which is held in the forceps. The current will electrocoagulate it but will

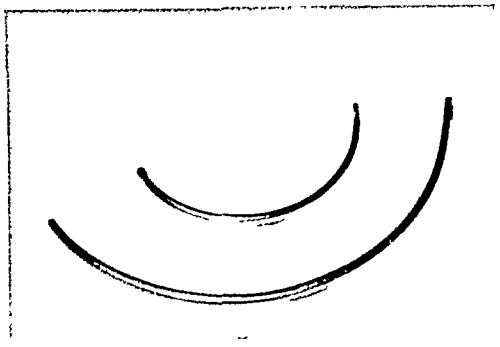
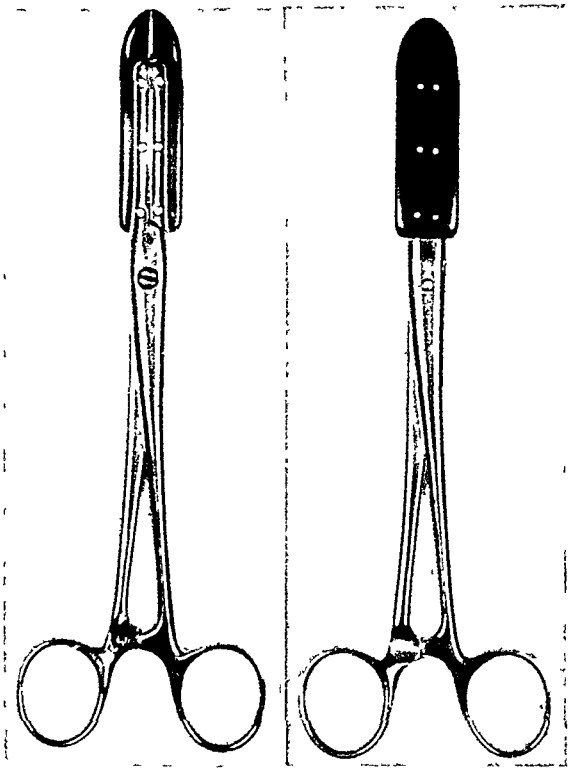


Fig. 21. Needles used by author in operations on the liver and biliary passages. The smallest size is used for ligating the cystic duct and artery; the larger, in emergency operations on the liver. One extremity of the needle is olive pointed, thus avoiding injury to the liver substance.

not pass beyond the insulated part of the angiotryptic forceps. Release the forceps; a compressed coagulated ribbon of tissue remains (Fig. 25). Repeat the procedure the same way all around. Electrocoagulate the remaining portion of the posterior wall of the attached gall bladder, which has not as yet been acted upon. I use a short wave apparatus.

In my early cases I thought it advisable to electrocoagulate slowly but experience has taught that quick, decisive coagulation has yielded the best results. The reasons for this are:

less moisture than tissue coagulated more slowly. Less heat is radiated to the contiguous tissues. Another reason for sub-



A B

Fig. 23. Author's angiotryptic forceps. A. front view, B. back view. Ordinary artery forceps sheathed in rubber serves the same purpose.

stituting rapid coagulation with a smaller electrode is that slow coagulation results in heating of the tissues to quite an extent

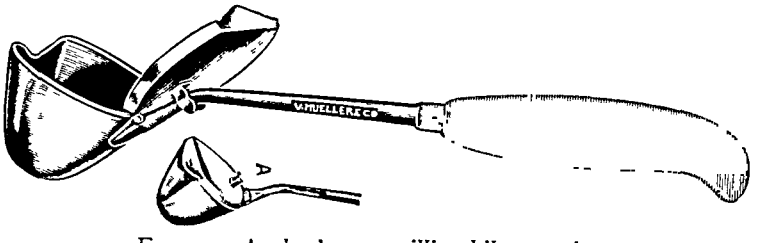


Fig. 22.—Author's non-spilling bile container.

I use a low current voltage and high amperage on a rather moderate sized electrode. On this unit as the voltage drops, the amperage increases. This affords prompt, thorough dehydration and a sharply defined line of demarcation between the coagulated and non-coagulated tissue. Tissue thus coagulated will retain beyond the electrode, about 0.5 cm. to each mm. There is no sharp line of demarcation in slow coagulation; the tissue changes are gradual.

When the diatherm is used the electrode should be applied snugly to avoid carbonization. The current should be turned on only *after* the electrode is firmly applied and

should be shut off before the electrode is removed from the cauterized surface. Avoid fulguration and its attendant carbonization.

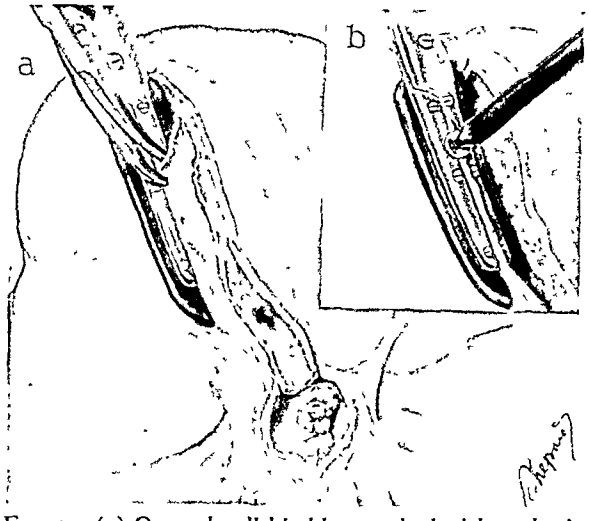


Fig. 24. (a) Opened gall bladder crushed with author's insulated angiotryptic forceps and redundant portion of gall bladder removed with ordinary scissors.

(b) Remaining strip of gall bladder in grasp of forceps being electrocoagulated with short wave current. The current passes through the forceps but not beyond insulated protector.

It will defeat the purpose of the operation. Any bleeding from the branches of the cystic artery is controlled by grasping the vessel and touching the artery forceps holding it with the electrode. Hemostasis will promptly result (Ward's procedure).

There is now an area represented by the electrocoagulated posterior wall of the gall bladder attached to the gall-bladder bed and the rest of the gall bladder not treated (Fig. 25).

Step 6. Approximate the electrocoagulated edges of the gall bladder by a few interrupted sutures (Fig. 26).

Step 7. Some peroxide of hydrogen on a sponge is applied to the gall-bladder bed area. The falciform ligament which it will be remembered is still in the abdominal cavity attached by a narrow pedicle is delivered, the pedicle grasped with an artery forceps, a ligature thrown around it below the forceps and the ligament detached completely with the scissors. One end of the detached falciform ligament is sutured to the upper end of the united, coagulated gall-bladder bed. The lower third of the ligament is now stitched to the lowermost end of the approximated, electrocoagulated surface and the free end of the ligament is placed, but not sutured against the doubly ligated end of the cystic duct and artery.

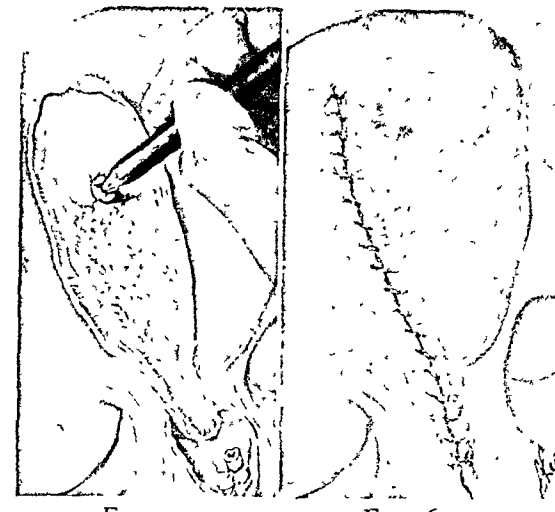


Fig. 25. Fig. 26.

Fig. 25. The insulated angiotryptic forceps are removed leaving ribbon of crushed and electrocoagulated strip of gall-bladder tissue all around gall-bladder bed. The posterior wall of the gall bladder in the middle of this ring is being electrocoagulated.

Fig. 26. Strip of electrocoagulated and crushed ring of tissue of gall bladder united with sutures.

Table II
(Compare This with Table I.)

Total number of cases	201
Males	26
Females	175
Age of patients—youngest	18 years
oldest	74 years
Average high temperature	100°F.
Average number of days in hospital	15.5

Pathologic conditions found at operation: Acute and chronic cholecystitis, cholelithiasis, hydrops vesica fella, empyema of the gall bladder, acute hemorrhagic cholecystitis, hepatitis, adhesions, chronic pancreatitis.

Postoperative complications: None, except in one case in which a cholecystelectrocoagulectomy was done for gangrenous cholecystitis and cholelithiasis. The sutures were removed on the eleventh day. The wound healed by first intention. On the tenth postoperative day symptoms of bilateral pleurisy with effusion were noted, which cleared. The patient left the hospital on the twenty-seventh day in good condition.

Mortality: One death one week after operation, of a female patient fifty years of age. At autopsy a ruptured old subdiaphragmmatic abscess which was not diagnosed before operation was found. The *operative area was clean.*

An effective serous covering is thus formed over the gall-bladder bed and cystic duct (Figs. 27 and 28).

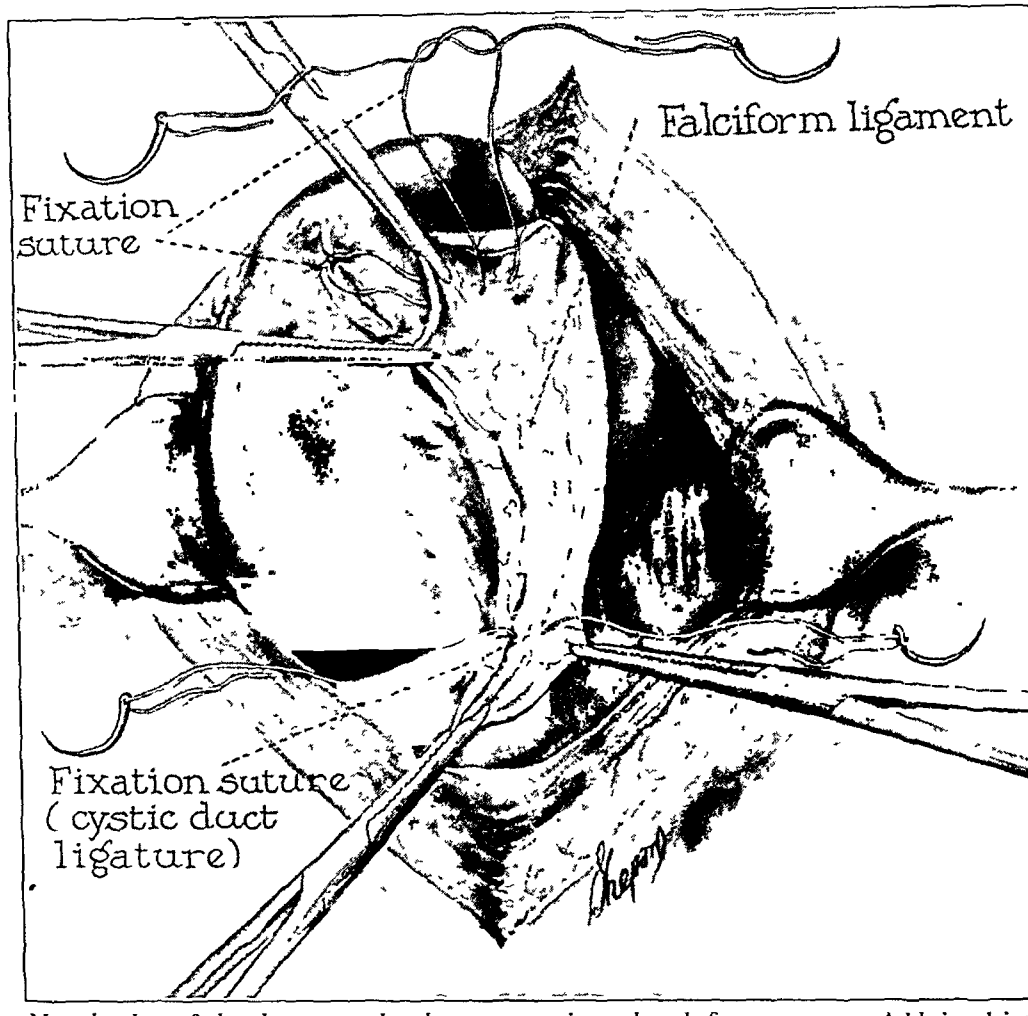


FIG. 27. Note borders of the electrocoagulated area approximated with fixation suture. Additional interrupted sutures of fine catgut approximate the borders of the electrocoagulated zone along its entire extent. The mobilized falciform ligament is fixed over the closed, electrocoagulated surface. Note placement of sutures.

Step 8. The laparotomy packs and retractors are removed; the field of operation is dried and the abdominal wall closed in the usual manner without drainage.

What becomes of the structures in the gall-bladder bed after the operation described? The answer to this has been given based upon animal experimentation. Recently, a postmortem examination was done on a patient who died of acute pulmonary tuberculosis on whom I performed a cholecystelectrocoagulectomy eighteen months prior to her last illness. Figure 29 shows the structure of the implanted falciform ligament. The gall-bladder bed is represented by unaltered cords of liver cells.

CONCLUSIONS

1. A method of electrosurgical obliteration of the gallbladder is described which when carefully followed may be used in simple and complicated cases of gall-bladder disease without resorting to drainage. It reduces mortality to a minimum and cuts hospitalization. The much dreaded age factor in these operations loses its terror. Shock is absent.[19]

2. Failures and fatalities in classic cholecystectomy after the operation are frequently due to bile leakage, as a

result of an inability to obliterate and cover the gall-bladder bed, which contains bile capillaries and often larger bile ducts, cause is an indication for cholecystelectrocoagulectomy.

6. Experimental studies have shown

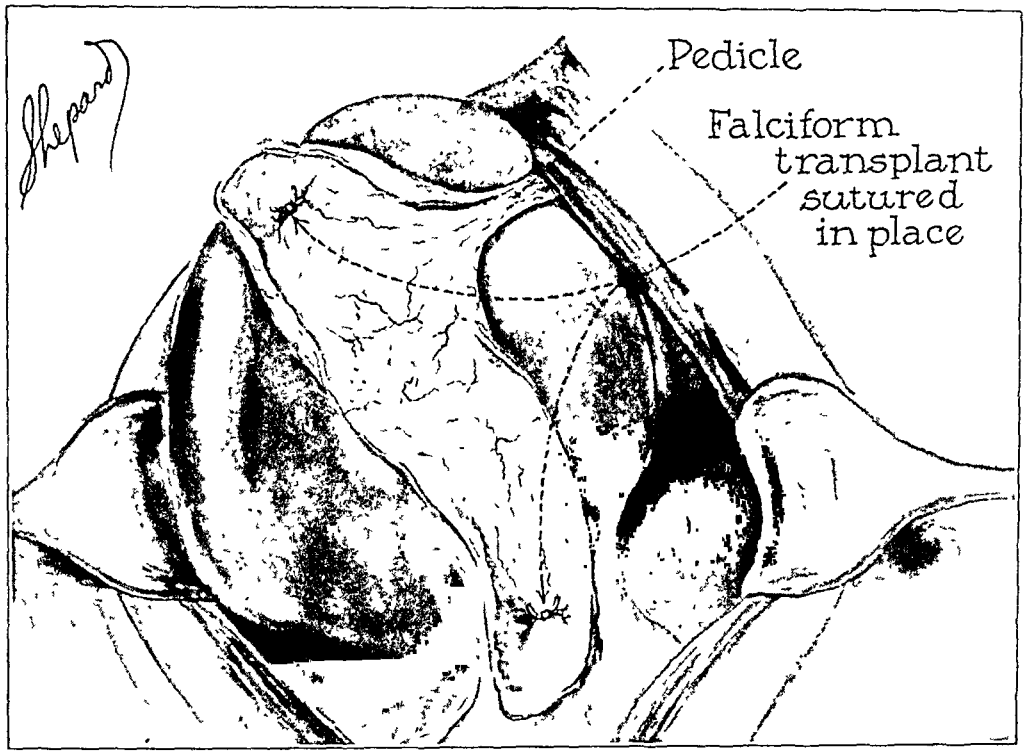


Fig. 28. Appearance of field of operation after completion of final stage.

in 15 to 25 per cent of the cases (Figs. 30 and 31). Drains invite bile seepage.[20] The method described seals these openings by electrocoagulation. A sterile, hyaline, dry protective layer is substituted for a raw, unprotected surface. The falciform ligament is superimposed over this area. Drainage is entirely omitted.

3. The term cholecystelectrocoagulectomy is descriptive of the procedure.

4. The operation here described must not be confused with mucoclasis; practiced with the cautery or diatherm fulguration which aims at burning or carbonization, of the mucous membrane of the gall bladder, or with so-called electrical or "electrocholecystectomy" where, instead of the scalpel, the diatherm cutting knife is used. These are entirely different procedures.

5. A prerequisite to the achievement of satisfactory results is a patent common duct. An occluded cystic duct from any

that any method of carbonization, as fulguration, Paquelin and electrocauterization predisposes to hemorrhage, thrombosis and embolism. Such cauterization will not destroy pathogenic microorganisms in the depths of the affected gall-bladder wall. Cholecystelectrocoagulectomy is free from these drawbacks and effectually accomplishes destruction of the entire thickness of the gall-bladder wall and if indicated, also the gall-bladder bed. The surgeon has under control the degree of penetration he wishes to accomplish (Fig. 32). E. L. Whitaker (loc. cit.) states, "The method of Thorek emphasizing contact coagulation to considerable depth seems preferable to fulguration. . . . I am grateful to Thorek for the distinction and wish to emphasize the necessity for real contact coagulation . . . "

7. The ligamentum falciforme hepatis is used as a free graft serosal structure

in covering sutured or raw surfaces to great advantage, thus reinforcing and protecting the areas concerned against



Fig. 29. Condition of tissues of gall-bladder bed one and one-half years after author's operation (low magnification). Observe histologically normal section of liver. All that remains of the gall-bladder bed is a strip of connective tissue. The falciform ligament shows its characteristic normal structure.

seepage and safeguarding the processes of repair.

8. Electrocoagulated areas of intra-abdominal organs tend to heal by encapsulation. They do not interfere with wound healing. On the contrary, they heal promptly when the wound is closed securely. Therefore, drainage is not only undesirable but is distinctly deleterious. Many patients succumb because of drainage. It prolongs the healing process and predisposes to infection. Cholecystelectrocoagulectomy eliminates the necessity of drainage and its unpleasant sequelae.

9. The thesis here presented deals with diseases of the gall bladder. Concomitant affections of the extrahepatic biliary passages will be the subject of an article to follow. It must be stated, how-



Fig. 30. Gall bladder removed elsewhere by classical cholecystectomy. Note large portion of liver tissue included with the gall bladder. (a) The latter, it is stated, could not be separated from the liver on account of extensive adhesions between liver and gall-bladder bed (magnified 25 diameters). Note dilated bile ducts (b) extending to the torn surface of the liver.

ever, that where choledochostomy or hepaticostomy is indicated, these may be done, in conjunction with the author's procedure. Experimental studies showed that the implanted falciform ligament over the obliterated gall-bladder bed forms sufficient protection and does not interfere with a Kehr or Orr tube.

10. Inasmuch as the global mortality of removal of the gall bladder by the scalpel method in complicated cases still ranges somewhere between 8 and 10 per cent or more, it stands to reason that if, as in the series of cases here reported, cholecystelectrocoagulectomy promises to reduce the mortality in unselected cases, barring unforeseen accidents such as result from anesthesia, precipitate hepatic insufficiency, etc., to near the zero point, the effort of acquiring an exact technic for its performance, it will be agreed, is truly worth while.

11. The authoritative report of E. L. Kellogg of having used my method in 16 cases and that of Finlayson in 4 cases without a fatality, is gratifying.

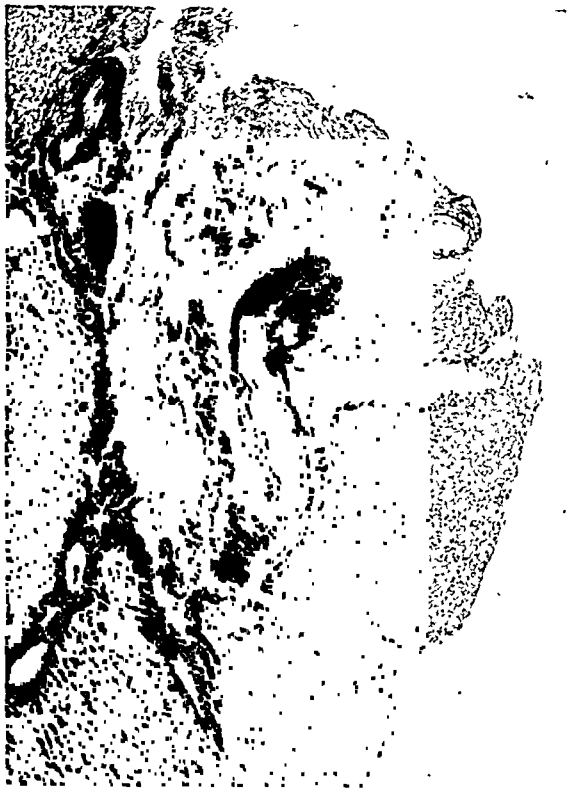


FIG. 31. Same as preceding (magnified 95 diameters) *extending to the surface of the torn liver edge.* Classical cholecystectomy elsewhere. Death 5 days after operation.

12. Electrosurgical or electrocholecystectomy, so-called, is nothing more than classical cholecystectomy where the electric cutting knife is substituted for the scalpel. It has contributed nothing to the improvement of the old method and has added the danger of explosion by sparking or fulguration. Furthermore, if coupled with drainage as practiced by Whitaker more drawbacks are added in the form of increased mortality of 18.75 per cent (loc. cit.).

13. Many decades ago attempts were made to destroy the gall bladder by carbolic acid and other escharotic substances. This is an antiquated procedure and quite ineffective, acting only superficially, demanding prolonged periods of drainage and often leading to fistulization.

14. Meticulous technic and a thorough understanding of the principles involved in the procedure are essential to the successful performance of the author's procedure described.*



FIG. 32. *Effects obtained from bipolar electrocoagulation* of muscular tissue. Note smooth action and degree of coagulation produced at will. Observe depth of penetration in upper specimen without carbonization and sagittal section of electrocoagulated area in the lower specimen. Note degree of penetration and marginal action of current. A strand of fascia blocked the progress of the coagulating process.

REFERENCES

1. ENDERLEN and HOTZ. Behandlung des Gallensteinleidens. *Klin. Wchnschr.*, 2: 648 (April 2) 1923.
2. VERBRYCKE. Gall-bladder operation mortality. *Southern Med. Jour.* 22: 452 (May) 1929.
3. BAKEŠ. *Zentrabl. f. Chir.* 55: 1858 (July 28) 1928.
4. DAVIS. Operative mortality and end results in gall-bladder surgery. *Ann. Surg.* 87: 735 (May) 1928.
5. ELLIS. Principles and Practice of Physical Therapy, W. F. Prior, 1932, p. 14.

[*For Remainder of References see p.* 438.]

*In the last series of cases the author used short wave electrocoagulation with gratifying results. It eliminates many drawbacks (no grounding of patient, precise coagulation, etc.) of the diatherm apparatus usually used.

OPERATIVE MORTALITY OF "INOPERABLE" CARCINOMA OF COLON AND RECTUM

JEROME M. LYNCH, M.D., F.A.C.S. AND G. JOHNSON HAMILTON, M.D.

NEW YORK

AMONG the "captains of the men of death" malignancy yields in rank only to heart disease. With a longer average life span carcinoma, especially in the digestive tract is of increasing importance. More than half the cases are found in the colon and rectum, thereby earning the attention not only of the specialist and practitioner but of the laity as well.

Our experience, with over 800 of these cases, has led us to certain definite conclusions.

1. To-day, surgery offers the only approach to the problem. The type of operation cannot be standardized, the individual must be studied carefully, although the procedure is relatively unimportant when compared with the skill and experience of the surgeon. We consider all forms of treatment such as radium and *x*-rays as adjuvant or purely palliative.

2. The operability of these cases is far higher than is commonly supposed by both the laity and the profession itself.

Well planned, radical surgery has restored innumerable patients to a normal and useful life; but many more have been labelled inoperable and condemned to a lingering death, alleviated only in part by palliative measures when surgery should have been given a chance. It is to the reduction of these so-called inoperable cases that all efforts are being directed. We feel that no useful purpose is served by the continual harping on the importance of early diagnosis, and that one should concentrate on disseminating the knowledge that many cases are not, in reality, hopeless.

There are three cardinal factors governing operability, (1) the skill and experience of the surgeon; (2) the condition of the patient; and (3) the site of the lesion, degree of local infiltration and extent of metastases. We have placed the ability and understanding of the surgeon first, because with an expanding experience comes a fixed unwillingness to refuse operation to any patient who by the greatest stretch of the imagination could be considered operable.

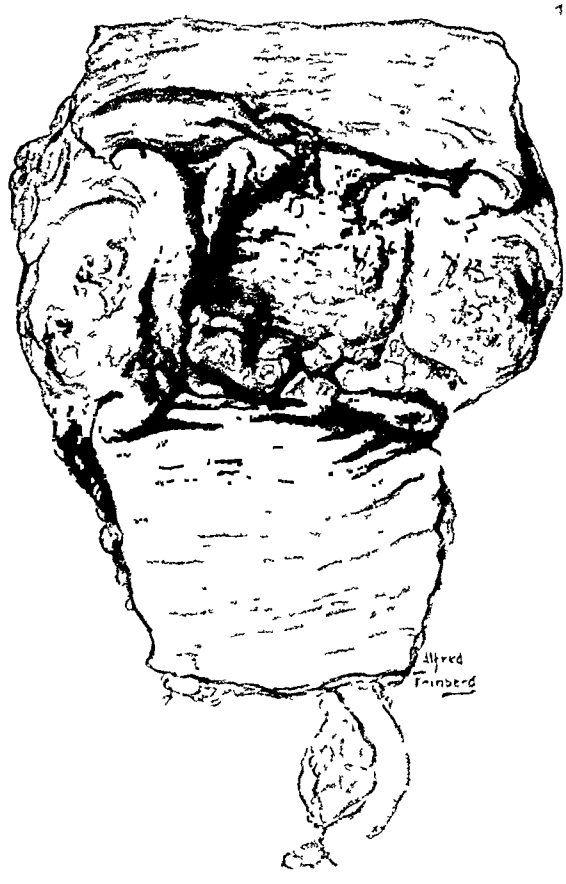


FIG 1. Case 1. Gross specimen.

The general condition of the patient is, of course, important but with improvement in preoperative and postoperative treatment, together with a better and larger armamentarium of anesthetics, the surgeon is no longer so severely restricted. Generally speaking anyone who is not moribund can be prepared to-day to withstand almost

any operation. Age is no longer a barrier, nor cardiac and pulmonary pathology a contraindication to lifesaving surgery.

1. The importance of carcinoma of the colon and rectum.

2. The increased percentage of cases which are truly operable.

3. The necessity of procuring a really expert opinion as to treatment.

4. The amazingly successful outcome of some apparently hopeless cases.

In support of these conclusions the following "inoperable" cases are offered.



Fig. 2. Microscopic section of adenocarcinoma. High power magnification.



Fig. 3. Case II. High power magnification.

The site and degree of fixation of the tumor were formerly of the utmost importance because the operation might become so severe and prolonged as to cause death from shock. To-day the expert surgeon is not so troubled even with the most difficult operation.

Both local and distant metastases once were considered sufficient to brand the case inoperable. Yet, what surgeon of experience in cancer cannot point to cases who lived many years of useful postoperative life, dispite not only metastases left behind but sometimes even actual primary growth?

We fully realize that we are offering an argument rather than a proof. We do not know whether carcinoma is increasing or not, but we do know that the operability rate *is* increasing. In conclusion we have endeavored to show—

Case 1. Female, age thirty-six years, was seen in November, 1927, complaining of three years duration of progressive constipation at times amounting almost to obstruction and marked loss of weight. She had consulted doctors at frequent intervals and was once *x*-rayed with resultant diagnosis of appendicitis. A famous Midwestern clinic recognized the condition and pronounced it inoperable.

Family History. Her mother died, aged fifty years, of carcinoma of stomach (inoperable).

Physical examination, a fixed mass, 5 × 8 cm. was palpated in the cul-de-sac.

Operation, November, 1927, Lynch's Modified Perineo-abdomino-perineal resection of the rectosigmoid with an end-to-end anastomosis

leaving the sphincters ani intact. Her recovery was uneventful.

Three months later, plastic operation on the perineum was done. Since then patient has been well, has performed her usual duties and has put on weight. She has always had full control of her feces.

Pathological Report. Adenocarcinoma. Histologically Grade II, Dukis Grade B. Figs. 1 and 2.

February, 1936, the patient came to the office for a follow-up examination. She feels well and is putting on weight.

Case II. Female, aged forty-two years, was seen April 4, 1926, giving a history of progressively increasing diarrhea with passage of blood, worse the last six weeks and which began three years ago with "mucous colitis." Three weeks ago a series of *x*-ray pictures of the gastrointestinal tract was followed by a blood transfusion. She had lost thirty pounds in the past year.

Examination. There was a hard indurated mass at the anorectal ring.

Operation. April, 1926. An abdomino-perineal resection of the rectosigmoid was done and blood transfusions of 700 c.c. were given pre- and postoperatively. The recovery was uneventful. In 1928, a papilloma of the anterior rectal wall, 6 cm. from anal the margin was removed by snare and its base cauterized.



Fig. 4. Case III. High power magnification.



Fig. 5. Case V. High power magnification.

In July, 1930, rectal discomfort led to the discovery of a recurrence in the anterior wall.

Operation. A portion of the vagina and 5 cm. of the lower bowel were removed and the sacral hollow evacuated. Her recovery was uneventful but a vaginal fistula persisted for some time. The patient has led a normal useful life ever since and has put on weight.

Pathological Report. First specimen Grade II. Dukis Grade B. Second specimenPapilloma, section cannot be found. Third specimen Grade III, Dukis Grade C. January 1936, she replied to a follow-up letter stating that personal affairs kept her too busy to come to town. She feels well and is gaining weight.

Case III. Male, aged thirty-four years, was seen December 5, 1923, complaining of diarrhea and severe pain in rectum. Three and one-half years ago, he had a sharp pain in rectum passing to the back and passage of blood and mucous. Recently there are 8–10 stools daily. Three years ago he had had a hemorrhoidectomy done. One month ago a biopsy of the tumor of the rectum was reported as malignant. Nine days ago radium was used but the

resultant pain was so severe that we were consulted as to the feasibility of a palliative operation. His family history was essentially negative.

Physical examination showed a weak, wasted, icteric individual. Rectally, an enormous mass, 5 to 6 cm. in diameter was felt above the prostate and bulged into the peritoneal cavity. Operation left rectus colostomy was done, Dec. 11, 1923 followed four weeks later by a perineal excision of the rectum and evacuation of the prostatic abscess. His recovery was uneventful. The patient has full control of the colostomy and is still leading a normal life.

Pathological Report. Adenocarcinoma. In February 1936, he was seen in the office for a follow-up. He feels well and is living a normal life.

Case IV. Male, age forty-three years, was seen April 20, 1926. Seven months ago he began to have pain in the lower left quadrant on defecation with explosive movements of gas and mucous. He had been treated by doctors and osteopaths.

Examination 13 cm. from the anus, on the anterior rectal wall, a large carcinoma was seen.

Operation May 5, 1925, a perineal resection of rectosigmoid was done. His recovery was uneventful. On March 2, 1936, the patient was endeavoring to secure life insurance.

Pathology Report. Adenocarcinoma, histologically, Grade II, Dukis B.

Case V. Male, aged sixty-three years, was seen December 6, 1929. His family and past history were essentially negative. For the past three or four years he has been ill, presumably peptic ulcers. Four months ago he had a prostatectomy and two months ago a cholecystectomy was done. At this operation "inoperable" carcinoma of the cecum was diagnosed. He had no relief from either operation. After operation he had hiccoughs which lasted sixteen and eleven days respectively.

Operation Dec. 14, 1929. The right half of the colon with carcinomatous mass at distal 8 inches of the ileum was removed and a ileocolostomy was done. His recovery was uneventful. The colostomy was well controlled; the stools were *well formed.*

Pathology Report. Adenocarcinoma. Grade II, Dukis B. In February 1935, the ileocolostomy was closed at the request of his bride. His recovery was uneventful. The patient feels well, and works harder than ever. In February, 1936 was seen at the office, "Feels better than ever."



REFERENCES OF DR. THOREK*

6. Thorek. Cholecystelectrocoagulectomy without drainage in the treatment of gall-bladder disease. *Ills. Med. Jour.* (Nov.) 1933.
7. Thorek. Electrosurgical obliteration of the gall bladder. *Jour. Am. Med. Assn.*, 103: 169–174 (July 21) 1934.
8. Thorek. Electrosurgical obliteration of the gall bladder (one hundred and twenty consecutive, unselected cases without mortality). *Arch. Phys. Ther.* 16: 207–218 (April) 1935.
9. Trowbridge. Electrosurgery. *Physical Therapeutics.* 46: 585, 1928.
10. Heymann. Operative Eingriffe mittels hochfrequenter Strome. *Klin. Wchnschr.* 9: 1376 (July 19) 1930.
11. Pribram. Fortschritte in der Chirurgischen Behandlung des Gallensteinleidens; *Mediz. Klin.*, 24: 1187 (Aug. 8) 1928; *Zentrbl. f. chiv.* No. 17, 1929.
12. Pribram. *Compt. rend. Cong. internat., lithiase biliare, Paris,* G. Doin, 1933.
13. Schmiedheiny. *Arch. f. Clin. Chir.* 140: 548, 1927, 1928.
14. Albertin. *Lyon chir.* 30: 207 (March–April) 1933.
15. Whitaker. *New England Jour. Med.*, 203: 15, 718–722 (Oct. 9) 1930.
16. Whitaker. *New England Jour. Med.*, 213: 13, 596–601 (Sept. 26) 1935 and 213: 14, 674–681 (Oct. 3), 1935.
17. Thorek. Surgical Errors and Safeguards. J. B. Lippincott & Co. 1934.
18. Thorek. *Am. Jour. Surg.*, 30: 2, 389 (Nov.) 1935.
19. Schörcher. Uber Shock, Kollaps und eletrochirurgie, *Detsch. Zeitschrift f. Chir.* 243: 245 (May 1934).
20. Stanton. Immediate causes of death following operation on the gallbladder. *Am. Jour. Surg.* 8: 1026 (May) 1930.

* *Continued from p. 434.*

ORGANIZATION OF TRANSFUSION SERVICE AND BLOOD DONORS BUREAU FOR AVERAGE HOSPITAL

HAYES E. MARTIN, M.D., F.A.C.S.
Attending Surgeon, Memorial Hospital
AND RUTHE WHYTE
NEW YORK

THE organization of a Transfusion Service and Blood Donors Bureau, which we describe in this report, is one which has been in successful operation at the Memorial Hospital for the last six years.

Prior to the development of our present system, there were several reasons why the procedure of blood transfusion did not have the full confidence of our Attending Staff. In the first place, a suitable donor could not always be obtained in time to be of service in an emergency, and in any case, the procedure could seldom be scheduled at a definite time with the assurance that a suitable donor would be available. Furthermore, severe posttransfusion reactions occurred with sufficient frequency to cause blood transfusions to be regarded with some apprehension.

The responsibility for these posttransfusion reactions was not definitely fixed, and therefore no direct steps were taken to determine the cause. Those who had selected the donor and performed the compatibility tests were always of the opinion that the technique of the transfusion itself was at fault, while the surgeons were equally certain that an error had been made in the compatibility tests. We are of the opinion that posttransfusion reactions are in most instances due to an incompatibility of the admixed bloods, and rarely to faulty technique in the transfusion itself.

Immediately after the occurrence of a posttransfusion reaction, a determined effort should be made to track down the responsible error. The search should logically begin at the most likely source of error, that is, the compatibility tests. These tests should be repeated, and with fresh samples of blood, if these are obtainable. If the bloods are found to be compatible, then inquiry into the technique of the transfusion itself must be made. The fault, whether in the blood tests or transfusion technique, cannot be readily discovered and subsequently avoided under a system of divided responsibility, such as is found in most hospitals where the Surgical Department performs transfusions with donors selected independently for them by the Laboratory Department.

At the Memorial Hospital, under our present plan of organization for a Transfusion Service, reactions occur very rarely, and are never alarming in character or degree. Cross matched and compatible donors are delivered to the operating room at a scheduled time, and the procedure of blood transfusion has attained the dignity of any other surgical procedure, and enjoys the full confidence of our Surgical Staff. We submit this plan as a tested and practical method of insuring the safety and availability of blood transfusion within a given institution.

The personnel of the Transfusion Service in Memorial Hospital consists of a surgeon and one specially designated member of the Laboratory Staff, who is known as the Laboratory Assistant. The surgeon directs and is responsible for all phases of the Transfusion Service, such as the selection of donors, blood typing, compatibility testing, and the routine operating room technique of the transfer of the blood, although any member of the Attending Staff may perform his own transfusions, if he so desires. The surgeon in charge of the

Transfusion Service is familiar, by training and experience, with the technique of compatibility testing, and in the case of a doubtful agglutination reaction, he is consulted and assumes full responsibility for the compatibility of the donor to be used.

We have a standardized form of operating room technique, which is a modification of the Lindeman multiple syringe-canula method. This method is, we believe, the most flexible and practical method of blood transfusion yet devised. It requires a surgeon and an assistant, but this fact is an advantage, since it permits the systematic training of the House Staff.

The form of all the laboratory tests is approved by the Director of Laboratories, but the Laboratory Assistant has full charge of the Donors Bureau, the supply of stock sera, and personally performs all typing and compatibility tests, and certifies the donor as being suitable for each transfusion. One of the most important and practical benefits of such an organization is that there is no division of responsibility, so that any untoward reactions following

HOSPITAL

NAME _____ FILING NO _____

CASE NO _____

RECORD OF TRANSFUSION

COMPATABILITY TESTS

Patient Jansky grouped by _____

Donor Jansky, grouped by _____

Cross / One way } matched by

DONOR: Name Age M S W D No of previous transfusions.

Address Tel Family Friend—Professional

Hb % Date registered 192

TRANSFUSION: Date 192 Time A M—P M

Given by Dr Ass't Dr Reason for transfusion

Method used Time consumed in the actual transfer of blood min

	Don	Rec
Arm of		
Vein delivered		
Direction of needle		

Amount of blood given cc

Events during transfusion

Condition immediately after transfusion

REACTION AFTER TRANSFUSION

If T P R. are abnormal during the first 48 hours following the transfusion state that fact and give the probable explanation in the space below

Temperature range during week preceding transfusion

High °F Low °F

NURSE'S RECORD

Time	T	P	R	BP
½ hour				
1 hour				
1 ½ hour				
2 hour				
2 ½ hour				
3 hour				
3 ½ hour				
4 hour				

RECORD OF BLOOD EXAMINATIONS: (Date and indicate whether before or after transfusion)

Date							
Hb							
Rbc							
Wbc							
Polym							
Large L							
Small L							

REMARKS:

FIG. 1. The Transfusion Sheet makes up a part of the permanent hospital record. After the recording of the compatibility tests, this form accompanies the donor to the operating room, where it serves to identify him as being compatible with a certain patient. The sheet also contains a record of the transfusion itself and of the patient's temperature the first few hours following the transfusion, as well as the record of blood examinations

transfusion may be thoroughly investigated without delay, the error discovered and steps taken to avoid its repetition.

considered simply as short cuts preliminary to selecting a donor who will probably cross match. The results of these tests, with the

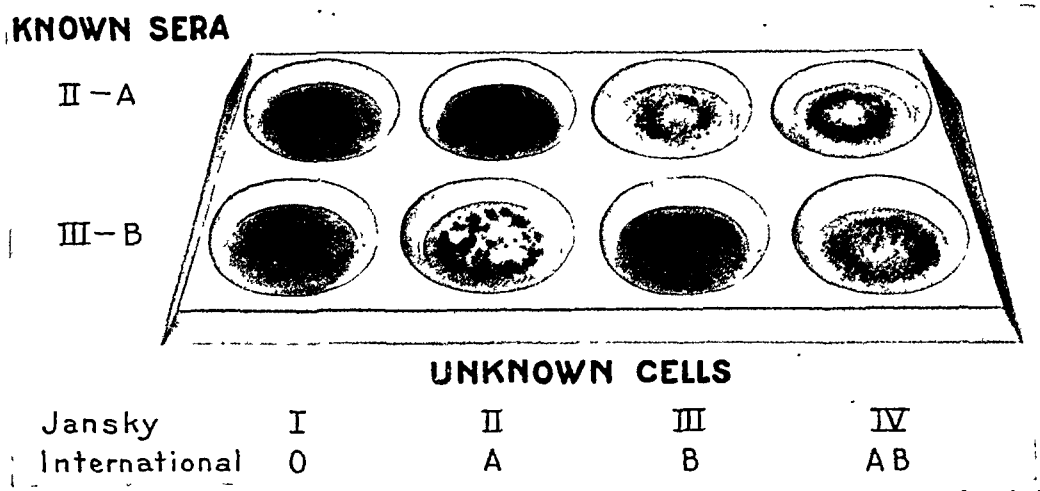


Fig. 2. The opaque white background of the china or porcelain trays used for mixing water colors is ideal for the determination of the agglutination reaction, and there is little temptation to use the microscope. These trays may be obtained in any shop dealing in artists' materials.

The details of an individual transfusion, under our organization, are usually about as follows: One of the members of the Attending Staff decides that a transfusion is required by one of his patients. He so informs the Resident Surgeon, who arranges with the patient for the donor's fee, or for the volunteer services of a relative or friend. The Resident Surgeon then sends to the Laboratory Assistant a specimen of the patient's blood, with a request for a donor at a specified time. If there are to be volunteer donors, samples of their blood are also drawn and sent to the laboratory with the proper information. The Laboratory Assistant then types the recipient's blood, and if a professional donor is to be used, one of the required group is telephoned to be on hand a sufficient interval before the time of the transfusion, so that further compatibility tests may be done.

The donor reports directly to the laboratory, where the Laboratory Assistant draws a few c.c. of his blood, separates the cells and serum, and cross matches both cells and serum with those of the recipient. This final cross match is considered the real test of compatibility, and is never omitted. The typing of the patient and donor are name of the patient and donor, are then written down under the proper headings on the "Transfusion Sheet" (Fig. 1), which accompanies the donor to the operating room. These data are checked again by the operating room nurse before the donor and patient are brought in for the transfusion.

After the completion of the transfusion, the Resident Surgeon fills in the data of the transfusion on the sheet, which must then accompany the patient back to the ward. The ward nurse takes the temperature, pulse and respiration every one-half hour for four hours, and notes these data in the proper place on the "Transfusion Sheet." If a chill or a temperature above 101°F. occurs within the first four hours, not explained by some other factor of the patient's illness, a reaction is said to have taken place. The cause of this reaction is investigated in every instance by repeating the compatibility tests, the cells and sera of both patient and donor having been saved for this purpose. Since establishing these precautions, we have not found any incompatibility of the bloods. The knowledge that a re-check will be made in the event of even a slight reaction will insure the most careful tests beforehand.

DONORS BUREAU

Any hospital where as many as fifty transfusions are done yearly may operate its own Donors Bureau with great convenience to the Staff and benefit to the patients. The use of a professional donors bureau will serve reasonably well for an occasional transfusion, but in our experience, the donors obtained from such sources are less reliable in character, and are often found to be suffering from secondary anemia as the result of too frequent giving of blood. It has never been possible for a donor to live entirely on the proceeds from his transfusions for any great length of time, without other resources. Nevertheless, many professional donors attempt to do so by registering at several professional bureaus. We have found several donors from such bureaus reporting for a transfusion with a hemoglobin of 40 to 60 per cent. In some of these instances, the donor was more in need of a transfusion than the patient, and in any case, the blood from these anemic donors if of little therapeutic value.

We have operated our own Donors Bureau for the last six years. At first, it was necessary to advertise for donors in the Help Wanted columns about once or twice a year. We accept only robust, healthy men of young or middle age. Since there is never a lack of applicants, it is best to reject all who have given more than three or four transfusions, and to give preference to those who have not previously acted as donors. The management of this Bureau is in charge of the Laboratory Assistant, who soon comes to know individually the more dependable donors. A donor is not used oftener than at three months intervals and will average about three transfusions a year. These men will bring in their friends as applicants, so that in recent years, we have not found it necessary to advertise for donors. At the time of the donor's first application, a special form is filled out and filed for future reference. This information is checked from time to time by means of a reply postcard, one section of which is addressed to the donor requesting that he fill in and mail to the Hospital the questionnaire set forth on the other part. It is to be noted that a telephone number is one of the most important qualifications of a donor. In New York City, a professional donor must also carry a "passbook," issued by the Board of Health. We have always complied with this ruling, though it has not been of any practical value to us.

Each time a donor reports for a transfusion, a hemoglobin test is made, and the serum saved for a Wassermann. After about six or eight transfusions, a donor should have a red blood cell count, as well as a hemoglobin test.

We know of no certain means of avoiding the theoretical transmission of syphilis by transfusion. A Wassermann test cannot be done immediately preceding each transfusion, and even if it could be done, it is still theoretically possible to transmit the infection. In practice, however, we know of no instance where such an accident occurred.

By subtracting a small percentage (5–10 per cent) of the donor's fee in suitable cases, we have established a transfusion fund. From this fund, we are able to pay all or part of the cost of a donor in a total of five to ten transfusions per year for indigent patients.

COMPATIBILITY TESTS

For practical purposes, we continue to use the Jansky system of blood grouping. The International System is probably more scientific, but it is apt to cause confusion in practice, especially from the clerical standpoint. There are often one or more persons involved in the giving of every transfusion to whom the presence or absence of specific agglutinins in the several blood groups, upon which the International System is based, will always remain a complete mystery. However, the Jansky System, using simply four numbers applied to the four groups, in the order of their frequency

of incidence, can hardly be a source of error.

We always insist that the donor and recipient be of the same type. The use of the so-called universal donor is not always safe, especially if large transfusions are given.

We believe that a direct cross match of the cells and sera of the patient and donor is the minimum precaution to be taken before any two bloods may be said to be compatible. Typing of the donor and recipient is simply a preliminary short cut, in order that a donor may be selected who will probably cross match perfectly. If two bloods are of the same type, they will almost invariably cross match, but, in our experience, *all errors in compatibility testing have occurred with bloods which were typed, but not cross matched.* In cross matching, the first donor may be rejected, and another selected, if there is any suspicion that agglutination occurs, whereas, in typing, the presence or absence of agglutination is of equal significance, and error cannot be avoided by discarding the questionable blood, especially if it belongs to the patient.

Stock sera of types II and III Jansky, or Moss, are kept on hand at all times for typing. These should always be dated and kept in the icebox, except when in use, and should be frequently renewed by saving the sera from types II and III blood, as they are tested. In institutions where few transfusions are done, the supply of stock sera is kept up with some difficulty, but may be renewed by calling in a donor. If necessary, perfectly satisfactory typing can be done, using both cells and serum of either II or III blood alone. It is best to keep several specimens of each on hand at all times. After two weeks, a serum tends to lose its potency. Freshly drawn serum is always most active and dependable.

Agglutination, the phenomenon by which blood groups are determined, is a macroscopic phenomenon. It is best observed on a white opaque background, and for this purpose we have found nothing more satisfactory than the china or porcelain trays which are used for mixing water colors (Fig. 2). These trays can be purchased in any shops dealing in artists' materials.

About one drop of freshly washed cells is mixed with ten drops of undiluted clear fresh serum. The mixture should be stirred frequently to facilitate agglutination, and to eliminate occasionally confusing phenomena, such as sedimentation and "graining." A final reading should be made after fifteen minutes. The reactions which determine the classification into the several groups are too well known to require discussion here. They are shown diagrammatically in Figure 2.

We are of the opinion that a microscope should never be used to determine agglutination. If agglutination cannot be observed by the naked eye, it is not there. If one becomes accustomed to the use of the porcelain or china trays used by water color painters, there will be little temptation to use the microscope. In 1922, Ottenburg stated, "The microscope is, in my opinion, a source of error. In every instance in which the doubt has been raised by microscopic examination and settled by the examination of the person's serum, as well as cells, the naked eye observation has proven correct, the microscope confusing." (*Jour. Am. Med. Ass.*, 79: 2137–2139, 1922.) With this opinion, we are in entire accord.

POSTTRANSFUSION REACTIONS

If within the first four hours after transfusion, a chill occurs with a temperature of 103° to 104°F., there can be little doubt that the donor's blood not only was grossly incompatible, but also belonged to a different group from that of the recipient. In such cases, a re-check of the bloods with cross matching will reveal the error.

In other cases, the temperature may rise one to two degrees or more, without any other serious symptom. If the recipient has been running an irregular temperature above the normal level during the preceding two or three days, a transfusion is usually followed within an hour or two by an elevation of temperature equal to the

highest level of the preceding period. Such a reaction is not specific, and is a well known phenomenon following any surgical procedure under similar conditions. A moderate rise in temperature is almost the rule following transfusions in Hodgkin's disease, and urticaria is also frequently observed. Urticaria, coming on as a post-transfusion effect, is probably a form of anaphylaxis. If the temperature rise is greater than any other experienced by the patient within the preceding forty-eight hours, the compatibility tests, especially the cross matching, should be repeated. When these have been carefully done, before-hand, it is an exceptional occurrence to find the second cross match different from the first. Nevertheless, we feel that these tests should always be repeated in such cases, simply as a matter of discipline. If a re-check of the tests reveals no error, the technique of the transfusion should be investigated. Causes of reactions attributable to the technique may be several, as for instance, the injection of too much saline, which is often impure, during the transfusion, the injection of too much air, the use of sodium citrate as an anti-coagulant, etc.

CONCLUSIONS

In our experience, the successful and safe operation of transfusion depends to a large extent on the following factors:

1. An undivided responsibility for the entire procedure, from the selection of the donor, the laboratory tests and the giving of the transfusion, to the re-check of any posttransfusion reactions.

2. The training of one Laboratory Technician to be directly responsible for all compatibility tests, the maintenance of stock sera, the selection, typing and cross matching of donors.

3. All those concerned with any of the phases of blood transfusion must freely admit that severe posttransfusion reactions do not occur without errors which are avoidable.

4. The cause of every posttransfusion reaction must be determined by a careful repetition of compatibility tests, and an inquiry into the technique of the transfusion itself.

5. It is highly desirable that each Hospital organize and maintain its own blood donors bureau.

GLOVE FLAP METHOD OF DORSAL HAND REPAIR

GERALD BROWN O'CONNOR, M.D.

Plastic Surgeon, St. Mary's and San Francisco Polyclinic Hospitals

SAN FRANCISCO

THE component structures of the hand are so arranged anatomically that they may act as units or collectively but these actions are dependent upon each other, therefore if there is a derangement of one unit it will materially affect the fine balance of the whole hand mechanism; units must act in complex unison to complete full functional actions. The loss of derma and subcutaneous tissue, although only a part of hand problems, may vitally affect hand function unless a satisfactory reconstruction towards the normal is evolved.



FIG. 1. Following a burn from gasoline, the dorsum of this patient's hand and fingers as far as the distal phalangeal joints was covered with a thick, heavy, red, painful, non-elastic keloid scar that prevented finger, thumb and wrist flexion.

An analysis of the coverings of the dorsum of the hand reveals that compliance must be made with certain specific anatomical arrangements when complete dorsal coverage is contemplated. The derma is durable, fairly thick, and so arranged in excess without being unsightly, that free action is obtainable in the finger webs, joints, and the complete hand and finger motions are unhampered. The subcutaneous tissue is thin but of sufficient quantity and quality over bones, tendons, and joints to provide free movement of the derma as well as acting as a buffer for the skin and the underlying delicate structures.



FIG. 2. The hand in a comfortable position in situ on the abdomen showing the finger, radial and ulnar pedicles nourishing the large central flap.

The usual causes for the loss of the dorsal covering structures are burns, infections, trauma or complete avulsion. Hands so injured present rather typical pictures when examined for repair. If the denuded area is permitted to epithelialize by its own efforts the scar is thin, tense, contracted and by its presence holds the wrist in extension, the metacarpophalangeal joints in hyperextension, the phalangeal joints in extension or partial flexion, and there is a loss of the normal convexity of the hand by the reduction of its transverse dorsal diameter. Occasionally the scar is a thick, red keloid holding all the joints in complete extension, acting as a check rein by its unyielding structure when finger flexion is attempted. If skin grafts have been applied to the denuded area its functional condition as well as its more normal relationship to the numerous joints is in direct proportion

to the time, amount and type of skin grafted, as well as to the eventual total scar formation and contraction. Even with



Fig. 3. The entire dorsum of the hand and fingers as far as the distal interphalangeal joints covered with a single piece glove skin flap. The slight edema of the digital flaps has subsided. Notice there is no webbing of the interdigital spaces.

early skin grafting the resulting covering is often thin, atrophic, non-durable, markedly reduced in total area and interfering with joint and tendon action thus incapacitating the hand as a normal grasping unit.

To obtain the most satisfactory functional and cosmetic restoration for the dorsum of the hand, a thin one piece unit of skin and subcutaneous tissue of the proper area for the hand, webs, and dorsum of the fingers is essential. The glove flap method fulfills these requirements with certainty and dispatch.

A description of the operations on the hand in the accompanying photographs depicts a typical glove flap replacement and is sufficient to give the basic principles involved in this method of repair.

Under a blood pressure tourniquet all of the scar on the dorsum of the hand and fingers was excised; the tendon and joint areas were freed of scar to permit their maximum activity. Following the tourniquet removal complete and accurate hemostasis was accomplished. This is important as postoperative hematomata are unusually destructive to any type of skin graft. An ordinary rubber surgical glove larger than the injured member was slipped onto the

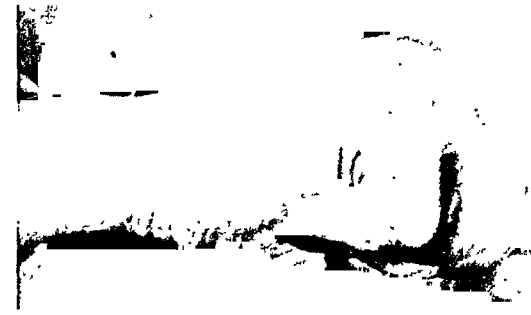


Fig. 4. Complete flexion of the fingers with a soft durable protective covering for the dorsum of the hand and fingers. Knuckles are easily discernible as well as normal dorsal arch and hand profile.

hand and sutured along the denuded edges. That portion of the rubber glove covering the defect was removed and a pattern of the denuded area obtained, sufficient material being allowed for the webs and the full range of finger motions. This pattern was placed on the right side of the abdomen and the donor skin flap and nourishing pedicles were outlined. Seven pedicles were constructed to serve and drain the center flap, one on the radial side, one on the ulnar side, and one for each of the digits. The entire flap with its attached pedicles was then elevated by sharp dissection, care being taken to make the flap as thin as possible without jeopardizing the circulation. The abdominal bed was covered with three large split skin grafts sutured into position. The injured hand was placed in the abdominal pocket and the flap pattern was sutured to the hand. The principle of parallel incisions was employed in the interdigital spaces to prevent the formation of troublesome webs. Seven days after the glove flap was created the digital pedicles were cut off under local anesthesia and sutured to the appropriate finger ends. Five days later under local anesthesia the ulnar pedicle was excised from the abdomen and sutured into position on the hand, and one week later the radial flap was similarly treated. The immobile hand with its appropriate pressure acted as a splint for

the abdominal skin grafts so that when the hand was removed from its abdominal bed a complete covering of the donor area was effected. The entire dorsum of the hand and fingers was completely covered in nineteen days by the skin glove and the patient had a total hospitalization of twenty-two days. Supervised elastic traction was applied to the fingers one week after the last operation and within a period of another ten days a complete range of hand and finger motions was obtained. At the present writing sensory nerve regeneration has taken place throughout the entire flap as evidenced by the return of sensation to pain and temperatures.

The glove flap method is highly satisfactory for quick and efficient dorsal hand coverage and the donor material so simulates the normal covering that unless irreparable deeper damage is done at the time of the original injury a maximum return of function and appearance can be expected.

SUMMARY

The fine balance of the hand mechanisms is so dependent upon the perfect functional inter-relationship of all its component parts that the damage to any one structure has an appreciable effect on the total hand action. A normal skin and subcutaneous covering is thus essential to good functional reconstruction.

A description of the operations carried out on the hand shown in the accompanying pictures depicts a typical glove flap replacement. The entire scar on the dorsum of the hand and fingers was excised. A surgical glove was placed on the hand and sutured along the denuded edges. The portion of the glove covering the defect was cut out, a pattern of the hand defect was made on the right side of the abdomen and the donor flap and seven pedicles, one for each finger; one for the ulnar and the radial side, was elevated by sharp dissection. The center flap and pedicles were made as thin as possible. The abdominal bed was skin grafted and then the injured hand was placed in the abdominal pocket and the flap pattern sutured to the hand. The digital pedicles were amputated in seven days, the ulnar pedicle in five days more, and the radial pedicle in one week more. The flaps were cut off under local anesthesia and sutured into their respective places and at the time of freeing from the abdominal wall complete take of the abdominal skin grafts was observed. The entire dorsum of hand and fingers was covered in nineteen days with a hospital stay of twenty-two days. By using elastic traction seven days after the last operation, a complete range of active finger motion was quickly obtained. At the present writing sensory nerve return has taken place.

The glove flap method is highly satisfactory for quick and effective dorsal hand coverage and the donor material so simulates the normal covering that unless irreparable deeper damage is done at the time of the original injury a maximum return of function and appearance can be expected.



Fig. 5. The abdominal donor area completely covered with pliable durable split skin grafts. The visible scars will gradually smooth and fade so that the eventual cosmetic deformity is negligible.

SKULL FRACTURES*

STUDY OF 100 CONSECUTIVE CASES

EDWIN G. RAMSDELL, M.D.

Director of Surgery, White Plains Hospital

WHITE PLAINS, N. Y.

THE importance of the problem of the fractured skull increases with the rising mortality from vehicular accidents. The wide distribution of motor traffic has, of necessity, placed the responsibility for the management of these accident cases in the hands of the general surgeons of the country. The rural districts and the smaller hospitals are receiving 64 per cent of these patients.

In reviewing the recent literature on the subject of the management of cranial injuries, a surgeon is impressed by the radical and fundamental differences of opinion expressed by authors of equal authority and experience.

From Baltimore comes a warning against lumbar puncture and dehydration and an endorsement of subtemporal decompression to relieve increasing intracranial pressure; from Philadelphia comes the strongest recommendation for dehydration; from New York, as a result of thirty years experience at the Harlem Hospital in the treatment of 1760 cases, comes a recommendation for routine lumbar puncture and a strong condemnation of the dehydration treatment so enthusiastically recommended in Philadelphia; from Boston comes advice to begin dehydration early, reserving spinal puncture and operation as successive steps to be used in combatting an increasing intracranial pressure; and from Chicago, after a careful resume of 2445 cases, comes advice similar to that emanating from Boston, with perhaps less enthusiasm for spinal puncture and a strong warning against early operation, especially in the presence of shock. In view of this confusion of expert advice, general surgeons should be interested to check their own results and attempt to lower the average mortality of 25 per cent.

With this objective the following study has been made. Table 1 indicates the increasing number of accidental deaths and emphasizes the importance of this problem.

TABLE 1

INCREASE OF FATAL ACCIDENTS

Accidental deaths 1913.....	82,460
Accidental deaths 1932.....	89,167
Accidental deaths 1933.....	91,087
Accidental deaths 1934.....	101,000

Motor vehicular deaths in 1934—36,000, 15 per cent increase over 1933; 64 per cent of motor vehicular deaths occur in the rural area. Persons injured by motor vehicles in 1934, 1,250,000, or 1 of every 100 population. It is estimated that in the United States 112,000 skulls are fractured annually with 28,000 deaths, a mortality of 25 per cent.

TABLE II

FRACTURE OF SKULL

ANALYSIS OF 100 CONSECUTIVE CASES

Sex Distribution		Age Distribution		
Male.....	79	2– 5 years	11 cases	41 cases with 5 deaths or a mortality of 12.1 per cent
Female....	21	5–10 years	14 cases	
	——	10–15 years	5 cases	
	100	15–20 years	11 cases	
		20–30 years	20 cases	59 cases with 18 deaths or a mortality of 30.5 per cent
		30–40 years	16 cases	
		40–50 years	10 cases	
		50–60 years	7 cases	
		60–70 years	3 cases	
		70–80 years	3 cases	

Table II emphasizes the fact that the mortality in the group of 41 cases under twenty years of age is about one-third that of the older group. It also calls attention to the importance of knowing the age

* Read before the Surgical Section of the New York Academy of Medicine, October 17, 1935.

distribution of the cases in estimating the mortality figures of any given series.

Table III
CAUSE OF ACCIDENTS

Agent	Number of Cases
Auto	62
Fall	19
Coasting	6
Struck by train	2
baseball	2
beam	2
golfball	1
baseball bat	1
glass bottle	1
sign	1
cement block	1
flatiron	1
iron pipe	1
	100

It is interesting to note that 62 per cent of these cases were caused by motor vehicular accidents and to remember that 64 per cent of motor vehicular accidents resulting in deaths occur in rural areas.

Table IV
X-RAY FINDINGS

X-ray film taken		46 cases
Positive for fracture	37 cases	
Unsatisfactory	3 cases	
Questionable	3 cases	
Negative for fracture	3 cases	
X-ray film not taken		54 cases
Condition too serious	11 cases	
Fracture visualized at operation	43 cases	

The *x*-ray picture is of great importance in making a diagnosis in doubtful cases. No head injury should be discharged until a fracture has been eliminated by *x*-ray examination.

It is not necessary for many obvious cases and should never be permitted while a patient is in shock. Only 46 per cent of these cases were *x*-rayed.

PATHOLOGY

The most difficult and important part of this problem is to estimate the extent of pathology within the damaged cranium for rational treatment can be based only upon this information. Therefore each case must be studied individually for many times it is impossible to know what has taken place within the skull of an unconscious patient.

We have listed in Table v some of the pathological conditions found in this series of cases.

The fracture line is of importance only insofar as it may be related to the damage of the underlying brain or as a possible source of infection.

Table V

Site of Fracture	Number Cases	Recovered	Died	Mortality Per Cent
Vault	66	56	10	15.1
Base	29	18	11	37.9
Base and vault	5	3	2	40.0

Complications	No. Cases
Compound fracture	2
Compound depressed fracture	24
Epidural hemorrhage	3
Subdural hemorrhage	10
Longitudinal sinus injury	2
Cranial nerve injuries	11
Fracture through frontal sinus	7
Fracture through cribriform plate	1
Fracture through middle ear	21

Table VI
ADDITIONAL MAJOR INJURIES

No. Cases	Site of Fracture
	Recovered
1	femur and humerus
1	tibia and fibula
1	humerus
1	ribs
1	ankle
2	malar bone
1	bilateral, femur and patella
1	compound, elbow, tibia and fibula
	Died
1	humerus
1	femur
1	malar bone and clavicle
1	nose and maxilla
1	ribs and internal injuries
1	compound, hip and both bones leg
1	bilateral, base and bilateral lower jaw

These additional major injuries add to the surgical shock and operative risk and mortality.

So far as was possible these patients have been treated on the basis of the estimated pathology and degree of intracranial pressure.

MANAGEMENT

From the point of view of management and in accordance with Mock's classification, these cases have been divided into four groups.

TABLE VII
CLASSIFICATION AS TO TREATMENT

		No. Cases	Recoveries	Deaths
Group 1	These patients had only rest in bed.	9	9	–
Group 2	These patients had special treatment for shock and concussion, other than lumbar puncture or operation. Five of the deaths occurred during the period of initial shock and before lumbar puncture or operation could be done.	51	44	7
Group 3.	These patients had special treatment and lumbar puncture for symptoms of intracranial pressure. Two of the deaths were due to late meningitis, and two occurred shortly after lumbar puncture.	10	5	5
Group 4.	Operated cases.			
		30	19	11
		Total	Recovered	Died
	Compound fracture	23	16	–
	Subtemporal decompression for epidural and subdural hemorrhage	7	3	4
		30	19	11

Group 1 includes the patients who, on admission, required no treatment other than rest in bed. There was no shock or disturbance of consciousness. There was a history of a head injury and *x*-ray evidence of a linear fracture. There were 9 of these patients and all recovered.

Group 2 includes all the patients outside Group 1 who had no spinal puncture and no operation. In this group are the patients who received treatment for shock and those who received dehydration treatment. In this group are included 5 cases so severely injured that death occurred during the initial shock. One case died suddenly on the third day and another died of pneumococcus meningitis following a frontal sinus fracture.

In Group 3 are included those patients who, in spite of dehydration and other treatment developed symptoms of increasing intracranial pressure and received one or more lumbar punctures but were not operated.

These were all serious cases. Lumbar puncture was not done as a routine but on definite indications of a rising intracranial pressure and breaking compensation.

There were 10 cases in this group with 5 recoveries. A brief description of the 5 fatal cases may be of interest.

CASE I. A man seventy-four years of age in very poor general condition with a fracture through the cribriform plate, developed a pneumococcus meningitis on the third day and died on the fifth.

CASE II. A young woman eighteen years of age, apparently recovering from a fracture through the frontal sinus, developed pneumococcus meningitis and died on the tenth day.

CASE III. A man thirty-five years of age had a spinal puncture five hours after admission for increasing intracranial pressure. He died five hours later without regaining consciousness. Autopsy showed a fracture through the right temporal bone with a large epidural hemorrhage in the right temporal fossa and a larger subdural hemorrhage on the left side with a laceration of the left temporal lobe.

CASE IV. A man fifty-five years of age with symptoms of increasing shock and coma. Lumbar puncture done twenty-two hours after admission delivered only a small amount of bloody fluid under no tension. He died seven hours later.

CASE V. A young man twenty years of age in profound shock from which he never recovered. One spinal puncture done withdrawing 10 c.c. He was given hypertonic glucose with no improvement and died within a few hours. This is the only case in the group about which a question might be raised as to the advisability of subtemporal decompression.

Group 4 represents the operated cases and comprises 30 per cent of the series. Twenty-three of these were compound fractures with more or less depression and comminution. There was no choice as to procedure in this group. Of the 7 subtemporal decompressions, 3 recovered. The 4 deaths were associated with ex-

tensive subdural hemorrhage and brain laceration.

A special technique to avoid additional trauma to the dura and brain tissue should be acquired by the surgeon who operates these cases. Special instruments, including a Hudson drill, saline irrigation and suction, bone wax, specially fine needles and silk should be provided by all hospitals accepting these patients for operation.

TABLE VIII

ANALYSIS OF DEATHS

8 cases died in initial shock, five minutes to a few hours after admission.

1 case died on the third day, questionable conservative treatment.

3 cases died of pneumococcus meningitis:
- 2 frontal sinus cases,
- 1 cribriform plate fracture.

11 cases died following operation:
- 7 severe compound fractures associated with intracranial hemorrhage and brain laceration,
- 4 subtemporal decompression for epidural and subdural hemorrhage.

6 of the deaths following operation occurred within the first forty-eight hours.

All of the 11 postoperative deaths seemed to be due to shock and brain injury.

TABLE IX

COMPARATIVE STATISTICS

Author's Series 100 Cases	Per Cent	Mock's Series 100 Cases Per Cent	Munro's Suggested Maximum Permissive Mortality—Per Cent
Non-operated cases	70.0	87.0	10–12
Mortality	17.3	17.2	
Operated cases	30.0	13.0	
Mortality	36.0	37.6	25
General mortality	23.0	20.0	15–17

Munro's suggested maximum permissive mortality is an arbitrary standard which he thinks might be reached by more particular study and attention to the management and care of these seriously injured patients. It is a reasonable goal.

If the surgeons and hospitals throughout the country could be aroused to study and report their individual mortality figures a general improvement in the care of these patients would follow with a reasonable hope of reaching the standards set by Munro.

SUMMARY

As 64 per cent of motor vehicle accidents occur in the rural districts and 60 per cent of skull fractures are due to these accidents, the treatment of a large number of skull fractures becomes the problem of the suburban hospital and the general surgeon. The present mortality of approximately 25 per cent should be reduced by the conservative management of these cases.

REFERENCES

Bagley, Chas. Jr. *Surg. Gynec. and Obst.*, 58: 498, 1934.

Connors, John F. and Wright, L. T. *Ann. Surg.*, 100: 996, 1934.

Dandy, Walter, *Jour. Am. Med. Assn.*, 101: 772, 1933.

Fay, Temple. *Jour. Am. Med. Assn.*, 80: 1445, 1923; 82: 766, 1924; 84: 1261, 1925.

Gurdjian, G. S. *Ann. Surg.*, 97: 327, 1933.

Jackson, Harry E. *Jour. Am. Med. Assn.*, 100: 731, 1933.

Mock, Harry, et al. *Int. Surg. Digest*, 17: 323, 1934.

Mock, Harry. *Jour. Am. Med. Assn.*, 97: 1430, 1931.

Munro, Donald. *New England Jour. Med.*, 203: 502, 1930; 210: 287 and 1145, 1934.

Naffziger, Howard C. *Surg. Gynec. and Obst.*, 56: 176, 1932.

DESCRIPTIVE TERMS FOR ABDOMINAL ELECTROSURGERY*

LESTER R. WHITAKER, M.D., F.A.C.S.

BOSTON

FROM time to time articles dealing with methods for abdominal electrosurgery have appeared, but as the subject is comparatively new the descriptive titles have been more or less clumsy, for instance, "electrosurgical gastro-enterostomy,"[1,2,3] "electrosurgical anastomosis,"[4,5,6] "electrosurgical cholecystectomy,"[7,8,9] "electrosurgical appendectomy,"[10] "electrosurgical enterostomy."[11] It is suggested that the word "surgical" be omitted and replaced by a hyphen, with the result as "electro-appendectomy." I am taking the liberty to apply these terms only to methods devised at the Massachusetts Memorial Hospitals, brief descriptions of which are given.

Electro-appendectomy. The base of the appendix is lightly crushed, tied with linen, amputated with the "cutting current," heavy dehydration, slowly with the flat of the blade to produce a cautery effect. Then the whole stump, including a section about 2 mm. below the linen tie, is thoroughly treated with the biterminal coagulating current by fulguration, or sparking, and light contact coagulation. The stump is then inverted with a double row of gastroenteric sutures. The advantage of the method is that after twenty-four to forty-eight hours the stump sloughs into the lumen of the cecum, leaving clean, infolded, closely approximately edges. Thus the chance of abscess in the cecal wall is avoided.

Electro-gastroenterostomy. At the sites for anastomosis on the stomach and intestine the seromuscular coats are incised with the ordinary scalpel, exposing the submucosa. This is thoroughly treated by fulguration and light contact coagulation. The charred areas are carefully approximated with a double row of gastroenteric sutures. Recently it has been found preferable to leave a free, untreated rim of mucosa about 1 cm. wide on the stomach side. This flap of mucosa tends to cover the granulating edges of the wound and reduce the amount of constriction at the stoma from sclerosis.

Electro-anastomosis of the Intestine. For lateral anastomosis the method is essentially the same as for gastroenterostomy.[2] For end-to-end anastomosis[4,5] the section of gut to be removed is doubly tied at either end, cut across between the ties with the "cutting current," heavy dehydration, slowly, for cautery effect. About 2 cm. from the ties on the ends to be joined, the gut is crushed with a clamp at right angles, to make a line of demarkation for the placing of sutures. Then the whole of either end of the intestine to be anastomosed is treated by fulguration and light contact coagulation, including the portion crushed with the clamp, which crushing incidentally helps to devitalize the gut. The coagulated "buttons" on either end of the gut are invaginated with a double row of joining gastroenteric sutures. After twelve to twenty-four hours the "buttons" of coagulated tissue slough, leaving the edges of gut well approximated. They heal with very little constriction of the lumen. This method is aseptic and safer than those used ordinarily.

Either before or at the time of the anastomosis it is generally advisable to perform an enterostomy. This may be done aseptically as follows:

Electro-enterostomy. A rubber tube with beveled end is sewed onto the bowel, the end being buried with inverting stitches. A rod slightly longer than the tube, carrying a loop electrode, is placed within it. Using

* From the Evans Memorial for Clinical Research and Preventive Medicine and the Surgical Clinic of the Massachusetts Memorial Hospitals, Boston.

the "cutting current," heavy dehydration, the wall of the bowel at the end of the tube is incised. The rod is withdrawn slightly to act as an obturator and the tube is then pushed through the opening as the sutures are tightened. The tube is stitched in place and the intestine at that point fixed to the abdominal wall.

Electro-cholecystectomy. With the "electric scalpel," heavy dehydration, (Bovie Unit), the gall bladder is split to the cystic duct, which is tied, if this can be done safely. Otherwise a tube drain is attached. With the same current the leaves of the gall bladder are cut away to about 1 cm. from the attachment to the liver, the branches of the cystic artery being clamped and tied as they are encountered. Then the mucosa on the section of gall bladder which remains attached to the liver is treated by electro-coagulation (Bovie unit) with high voltage, biterminal fulguration and light contact coagulation. This chars the surface slightly and coagulates to a depth of 2 to 3 mm., sufficient for destruction of the mucosa. The whole surface must be thoroughly treated because even a small section not devitalized may regenerate, leading to a persistent sinus. If the gall bladder is much thickened some of the tissue attached to the liver may be "scalloped" away with the loop-electrode, using "cutting current," heavy dehydration, after which the base is fulgurated as previously. This method seems preferable to deeper coagulation, leaving a considerable amount of dead tissue. Drainage is employed.

The advantage of electro-cholecystectomy lies in a better control of hemorrhage with the acutely inflamed or sclerotic gall bladder where there is considerable danger in ordinary cholecystectomy. It is not recommended, however, in the thin walled gall bladder which can be dissected readily.

Electro-cholecystocausis or Cauterization.[12] This procedure is applicable in those cases where the risk is so great that only a cholecystostomy is advisable. The object of "cholecystocausis" is to bring about obliteration of the gall bladder by an operation which involves little more shock than mere drainage. It is most easily adapted to the enlarged, palpable, thick walled gall bladder. Through a small incision the fundus is exposed, aspirated and opened widely. If it can be done without tension, the edges of the opening in the gall bladder may be stitched to the abdominal wall, otherwise the opening is maintained by guy sutures or clamps. Then with the aid of a focusing headlight and special insulated retractors, the whole mucosa of the gall bladder is thoroughly treated with biterminal fulguration, or sparking, and light contact coagulation. Deep coagulation, resulting from pressure of the electrode against the surface, must be avoided to prevent perforation of the gall bladder and damage to the adjacent structures. Several Penrose drains are placed in the cavity and the wound closed loosely about them.

With the poor risk patient who has a thin walled gall bladder, but with whom a cholecystostomy is indicated on account of biliary colic from stones, "cholecystocausis" may still be done. Extra care is required, however, in the treatment of the mucosa. The current must be light enough to avoid coagulation of the whole thickness of the wall, and only fulguration, with not too heavy a spark, and extremely light contact coagulation, is permissible. The treatment of the mucosa should be begun at the top and the serosa occasionally inspected with the object of avoiding color changes from deep coagulation.

If the treatment has been too light to destroy all the mucosa and a sinus persists after drainage, the process can be repeated with very little disturbance to the patient. It will now be safer on account of the inflammatory thickening of the gall bladder. This repetition of the treatment is preferable to causing perforation of the gall bladder at the first operation. For the beginner with the method it would be advisable to drain first, placing several rubber dam gauze wicks in the cavity. Several weeks later, after the gall bladder

had become somewhat thickened and walled off by adhesions, the sinus could be expanded and "cholecystocausis" performed. This procedure would also offer an advantage in those cases with persistent sinus after ordinary cholecystostomy, a means whereby the gall bladder could be obliterated without the danger of a difficult cholecystectomy. It would seem feasible to use the cystoscopic instruments and methods of the urologist for fulguration of mucosa in the depths of a sinus following cholecystostomy.

In certain cases of pronounced acute inflammation or gangrene of the gall bladder where the mucosa is already partially devitalized, "*chemo-cholecystocausis*," with carbolic acid for the cauterizing agent, can be employed. If there is vital mucosa, however, "electro-cholecystocausis" is more effective.*

SUMMARY

Simplified terms for electrosurgical procedures in the abdomen are suggested. The word "surgical" is omitted from titles used by the author or his associates. Brief descriptions of the methods are given.

Electrosurgical appendectomy[10] or electro-appendectomy.

Electrosurgical cholecystectomy[7,8,9] or electro-cholecystectomy.

Electrosurgical gastroenterostomy[2] or electro-gastroenterostomy.

Electrosurgical anastomosis[4,5] or electro-anastomosis.

Electrosurgical enterostomy[11] or electro-enterostomy.

A recent term is given, electro-cholecystocausis[12] (cauterization).*

REFERENCES

1. Ward, Grant E. The present status of electrosurgery. *Am. Jour. Surg.*, 6: 230 (Feb.) 1929.
2. Briggs, J. E. and Whitaker, L. R. An electrosurgical method for aseptic gastro-enterostomy. *New England Jour. Med.*, 201: 6 (July 4) 1929.
3. Kelly, H. A. and Ward, G. E. Electrosurgery. W. B. Saunders Co., Phil. and London, 1932.
4. Briggs, J. E. and Whitaker, L. R. An electrosurgical method for aseptic anastomosis of the intestine. *New England Jour. Med.*, 206: 662 (Mar. 31) 1932.
5. Whitaker, L. R. A case of megacolon. Treated by prolonged drainage, and aseptic electrosurgical resection and anastomosis. *Rev. of Gastroent.*, 1: 270 (Dec.) 1934.
6. Wadhams, R. P. and Carabba, V. Electrosurgical aseptic intestinal anastomosis. *Surg. Gynec. and Obst., 60: 1082 (June) 1935.*
7. Whitaker, L. R. Surgical management of gallbladder disease. *New England Jour. Med.*, 203: 718 (Oct. 9) 1930.
8. Whitaker, L. R. Electrosurgical cholecystectomy. I. Experimental observations. *New England Jour. Med., 213: 596* (Sept. 26) 1935.
9. Whitaker, L. R. Electrosurgical cholecystectomy. II. Clinical application. *New Eng. J. Med.*, 213: 674 (Oct. 3) 1935.
10. Whitaker, L. R. Electrosurgical appendectomy. *New Eng. J. Med., 213: 856* (Oct. 31) 1935.
11. Whitaker, L. R. Aseptic electrosurgical enterostomy: a new method. *Am. Jour. Digest. Dis. and Nutr.*, 2: 630 (Dec.) 1935.
12. Whitaker, L. R. Electro-cholecystocausis. *Am. Jour. Digest. Dis. and Nutr.*, 3: 62 (Mar.) 1936,

* In a personal communication my former "Chief," Dr. J. E. Briggs recalls a case of gangrenous gall bladder in which he inserted a finger under the blackened mucosa and enucleated it from below upward; after which the sinus closed permanently.

* For this term the writer is indebted to Paul J. McManus, S.J.

EFFECT OF HEAD INJURY ON HEARING AND ORIENTATION*

MARK J. GOTTLIEB, M.D.

Attending Otolaryngologist, Broad Street Hospital; Associate Attending Otolaryngologist, Beth Israel Hospital; Assisting Attending Otolaryngologist, Harlem Hospital

NEW YORK

INJURIES to the head that produce disturbances of hearing and orientation may be separated into three sections: (1) those which are directed to the ear or its environs, (2) those in which the force is applied to the skull not including the area of the ear and in which, from external appearances, the ear is not involved, and (3) those in which one or both ears are injured due to the force and direction of violence applied to the contour of the skull.

1. Direct injuries to the ear.

Force applied to the outside of the ear producing compression of the air in the external auditory meatus may produce rupture of the drum. When the force is great hemorrhage into the cochlea or semicircular canals or both may occur. Such injuries may be produced by a blow or from explosives. Usually the ear nearest the explosion is affected but it may affect both ears. Complete bilateral deafness from intense explosions occurring in negative pressure chambers has been observed. Such injurious agents as bullets and other sharp instruments with or without high velocity may penetrate the auditory canal or traverse the mastoid and injure the hearing and orientation either partially or completely.

2. Injuries to the skull but not directly into the ear accompanied by concussion of the brain, not necessarily associated with unconsciousness, may affect the hearing and orientation through injury to the pathways coming from the ears and traversing the midbrain and leading to the cerebellum and cerebrum. It has been stated that 90 per cent of cases of concussion complain of vertigo or giddiness and demonstrable abnormalities in response to labyrinthine stimulation can be elicited in most of them. In many instances the hearing is also impaired.

3. Direct involvement of the auditory and static-kinetic labyrinths besides injury to the nerve pathways and brain tissue particularly at the base occurs from crushing blows to the head with or without fracture of the vault or the base. A blow of sufficient force near the ear may damage the hearing organ and injure the brain through commotio cerebri. From such a blow a fracture through the petrous portion of the temporal bone and widespread injury to the intracranial contents is likely.

In this article only those injuries that produce disturbances of hearing and orientation resulting from indirect or combined direct and indirect force are considered.

The symptoms referable to such lesions are partial or complete loss of hearing, either unilateral or bilateral, tinnitus, nausea, vomiting, vertigo or variations of the same, falling and paralysis of cranial nerves.

The objective phenomena are unconsciousness, spontaneous nystagmus and past-pointing, impaired pelvic girdle reactions, instability, dysmetria, adiadochocinesis and the finding of blood in the cerebrospinal fluid. The hearing by audiometry is found to be reduced throughout the tone scale or more commonly the perception for high tones is less acute than those in the center or at the lower end. In some instances the hearing has been destroyed, particularly in cases wherein

* From the Otolaryngological Department of Broad Street Hospital.

the petrous portion of the temporal bone is the site of a fracture or where there has been a rupture of the auditory nerve. The nystagmus induced by rotation or caloric stimulation is not usually much affected although it is likely to last less than the normal time, particularly on the side at which the force was applied. In some instances the nystagmus is perverted. The responses to stimulation of the vertical semicircular canals are not very strong and in some instances neither past-pointing nor nystagmus can be produced. Past-pointing after rotation or douching is very likely to be abnormal and this finding is persistent unless the disturbance is due to injury to the end organ alone when it disappears with the adjustments and compensations which the body makes after such injuries.

When the acute symptoms subside there is a persistence of certain phenomena that gradually improve and others remain the same or they increase in intensity.

Ordinarily, the residual findings are hearing loss, spontaneous nystagmus and past-pointing, incoordination, vertigo and impaired reactions to passive or active changes in position such as falling and impaired pelvic girdle reactions.

Hearing. In many instances the hearing is impaired both by injury to the end organ through intralabyrinthine hemorrhage and injury to the auditory pathways. Recovery of all the hearing is likely when the injury to the cochlea is slight and the hemorrhage is meager. When the hemorrhage into the labyrinth is large the clot may become organized and the resultant scar tissue perpetuates or even augments the initial hearing loss. When there is little or no injury to the end organ, but there is loss of hearing acuity the fault is to be attributed to injury to the auditory pathways. In this instance the hearing may improve for a short time after the initial insult and then gradually become worse and finally remain stationary. At the time of the injury hemorrhagic extravasations and even lacerations have occurred along the auditory and vestibular pathways in the brain stem and cerebellum. Healing takes place and the bloody extravasations are absorbed, but in the areas of injury scar tissue is formed and the attendant contractions cause a latent progression of the symptoms. When the hearing is profoundly affected and vestibular responses are produced by turning or douching, the fault is not with the end organ, for if the injury is severe enough to produce marked deafness, the static-kinetic labyrinth would be equally or more extensively involved. The hearing loss is more likely to be unilateral when the end organ alone is affected and bilateral if the cause of the deafness arises from damage to the important structures below the tentorium.

Nystagmus. The nystagmus that originates from injury to the static-kinetic labyrinth rapidly disappears. It is rare to find spontaneous nystagmus of labyrinthine origin that persists more than forty-eight hours after head injury. Rhythmic movement of the eyes encountered a considerable time after the injury is due to injury to the cerebellum. This finding is not rare and its importance when present is of diagnostic and prognostic significance.

Nystagmus of cerebellar origin shows a slow deviation and a quick return in the horizontal plane. A lesion in the lateral lobe produces a deviation of the eyes to the side opposite the lesion and then a quick return. It is observed when the cerebellar nuclei are injured, probably due to loss of cerebellar influence on the vestibular nuclei of the same side. It should not be considered cerebellar unless there is superadded to this an ataxic movement of the eyes on looking to the right or left and increased by fixation.[1] The eye movements are pendular and increased by fixation to the right or left always horizontal and a delayed quick component. The pendular movements are more marked on looking to the side of the lesion which is the opposite to that which is observed in lesions of the labyrinth alone. The ataxic movement can be reduced or eliminated

by the application of lenses of 18 diopters. Cerebellar nystagmus persists and may be present even when the patient feels well and capable of resuming his occupation.

One must not place much significance upon post-rotational nystagmus of short duration or nystagmus that requires in its production douching with water at 68°F. for a longer period than is necessary with the normal labyrinth. Such lack of sensitiveness or delay in response is a common finding after head injury. Whether it is due to mild lesions of the vestibular pathways cannot be said. When however, the horizontal semicircular canals respond with nystagmus and not the vertical canals, intracranial disturbance must be suspected.

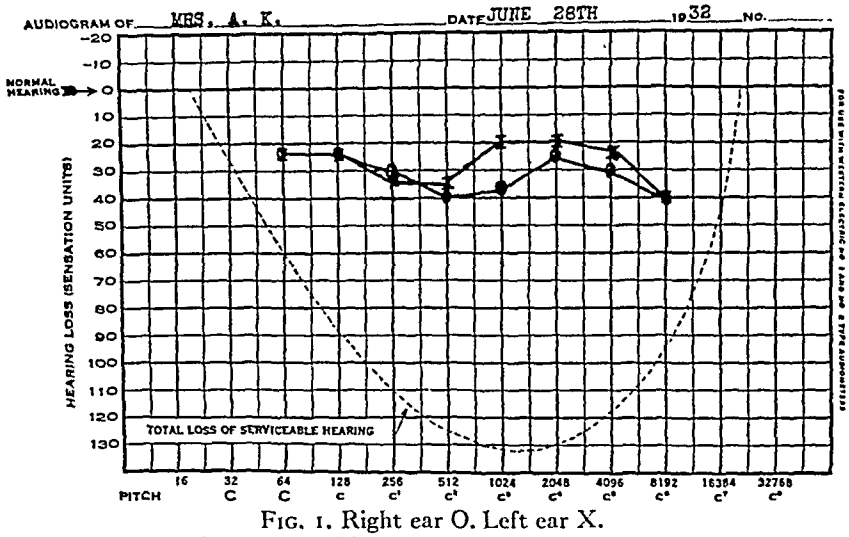


Fig. 1. Right ear O. Left ear X.

256 D.V.	Air	10 sec.	11 sec.
	Bone	6 sec.	7 sec.

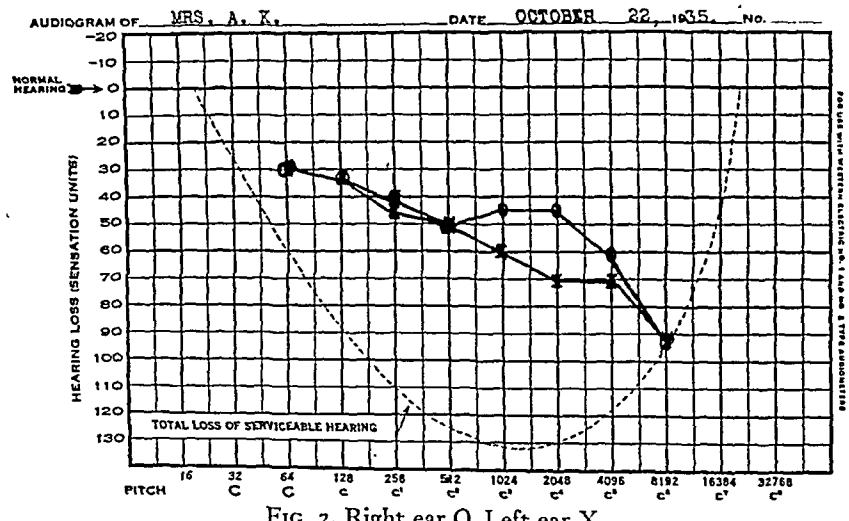


Fig. 2. Right ear O. Left ear X.

128 D.V.	Air	10 sec.	7 sec.
	Bone	7 sec.	6 sec.
256 D.V.	Air	6 sec.	9 sec.
	Bone	4 sec.	5 sec.

When such a finding is associated with profound unilateral deafness, tumor of the cerebellopontine angle must be considered. In the later stages of such a tumor, hearing and vestibular responses are practically obliterated and the responses to stimulation of the vertical canals of the opposite side give delayed or shortened nystagmus or not at all. The reduction of hearing in cases of head injury is usually bilateral and rarely is the function of one

or the other labyrinth completely nullified. In head injury a lack of response from the vertical canals is most likely due to damage of the vestibulo-ocular pathways. An induced nystagmus that is rotary when it should be horizontal or a nystagmus that moves in a direction opposite to that which is normally to be expected may be considered to be due to injury to the intracranial pathways or the nuclei which control the mechanism.

Past-pointing. Very rarely, within a period of three days following concussion spontaneous past-pointing may be found. This sign quickly disappears unless there has been severe damage to the cerebellum or its afferent and efferent pathways. Then it is associated with so-called cerebellar nystagmus. The spontaneous past-pointing arising from injury to the end-organ is never of long duration. Induced past-pointing in postconcussional cases is rarely normal. It is not as reliable as nystagmus because it may be influenced subjectively in the same way as the determination of the hearing acuity. When it is abnormal and not accompanied by perspiration, nausea, vomiting and falling from turning or prolonged caloric stimulation its authenticity cannot be questioned. In mild cases the past-pointing is not abnormal in direction nor is it absent but it is likely to be short in duration and extent. In the more severe cases, most of them come within this category, it does not occur at all, or it is shortened, or the direction is contrary to expectation.[2,3] Both arms are supposed to past-point after douching or rotation to the side turned or douched. It is common to observe one arm pointing to the right and the other to the left or no past-pointing at all after stimulation of the right semicircular canals and vice versa. Abnormal induced past-pointing may be elicited years after the injury.

After-turning Vertigo. The determination of the duration and direction of induced vertigo is of importance. When abnormal, it confirms and strengthens the value of induced past-pointing. Abnormal induced vertigo is found nearly as often as abnormal past-pointing. The direction of after-turning vertigo may be wrong or the duration shortened and the direction correct. In the severe cases both the direction of the vertigo and the duration are abnormal. The patient with the head upright is turned ten times in ten seconds. While he is being turned he repeats constantly in what direction he is going. The chair is stopped gently and the patient who is normal repeats that he is going in the opposite direction and continues to repeat the direction until the sensation of movement disappears. The duration is the time that the patient senses that he is rotating after the chair has stopped. In a great many cases of head injury the patient indicates that he is rotating in one direction when he should feel that he is turning in the opposite direction. The importance of this test lies in the fact that the patient cannot influence the result unless the performance is badly managed.

Positive Romberg, dysmetria, adiadochocinesis, faulty finger to finger and finger to nose test, paralysis, unstable equilibrium and falling are encountered following the more severe head injuries. All of these except paralysis of the cranial nerves and falling, are to be considered of cerebellar origin, indicating that either the cerebellum or the pathways that lead to the cerebellum have been damaged. Falling may or may not be of cerebellar origin. When it disappears soon after the accident it is likely to have been of vestibular origin but its persistence indicates that the subtentorial structures have been damaged. When the static-kinetic labyrinth has been severely injured and accompanied by either temporary or permanent suspension of function, the direction of the fall changes with an alteration of the position of the head. Falling from labyrinthine injury disappears quickly, but it can be induced by quick and unusual movements of the head or body. Cerebellar falling is characterized by its persistence and by the fact that the

patient will fall in one direction no matter what the position of the head may be.

Vertigo may be true or false. True or systematized vertigo is wherein objects appear to revolve around the subject in a definite direction and is associated with disturbances of the end-organ. Usually associated with this are spontaneous nystagmus, past-pointing and falling but only in the early days after head injury. False or non-systematized vertigo is a feeling of confusion or uncertainty. Patients describe it variously as giddiness, unsteadiness, wavering of objects, a feeling that the head is going up and down, the sensation that objects are receding and mental confusion under stress especially in crowds. It is a summation of the results of the various disturbances that persist after concussion. The great majority of patients who have suffered moderate or severe concussion complain of this symptom which persists for months and even years after the injury. It is considered to be due to a derangement of the ocular, tactile or joint-muscle sense or a combination of these originating from injury to the vestibular pathways and cerebellum unless normal responses are obtained from vestibular stimulation. Only when the result of such an examination is negative can we consider that the vertigo is of psychogenic origin.

People who complain of posttraumatic vertigo originating from injury to the brain stem and cerebellum should not be allowed to resume their occupations if that entails working at elevated and unprotected positions such as house painters, steel workers and the like. The mental confusion incident to an attack of giddiness may be sufficiently profound to allow accidental falling thereby endangering the life of the patient and those with whom he is immediately in contact.

The following case histories illustrate some of the points in the text.

CASE REPORTS

Case 1. Mr. M. M., sixty-four years of age, was first seen, December 18, 1928, complaining of deafness in the left ear, dizziness and a sensation that he was about to fall.

Two years previously he was hit by a taxicab, knocked down and then became unconscious. Upon regaining consciousness he vomited and was taken to Mount Sinai Hospital where he remained for two weeks. A summary of the record of the hospital is as follows.

Physical Examination. Patient is a middle aged man lying in bed, semistuporous but can be aroused and responds when aroused although somewhat confused and inarticulate. Muscularly, he is well developed. The skin is clear and moist. There is a small laceration on the front and left parietal region which is tender and boggy, but negative on percussion. The pupils are equal and regular, react sluggishly, movements under control. The nasal areas of the ocular conjunctiva are edematous. The fundi are normal. There are blood clots in the anterior nares, the mucous membrane is congested. The appearance of the ear drums is normal. The pharynx is full of blood clots. There is a left facial weakness and a definite obliteration of the nasolabial fold. The apex of the heart is barely palpated in the fifth interspace, the borders are not enlarged, the sound is distant and no murmurs were heard. A small skin discoloration was seen over the left hip. There was tenderness over the left greater trochanter with inability to circumduct the left hip. Motion of the legs, etc., were normal.

Neurological. Positive findings were rigidity of the neck on flexion, left facial weakness, deviation of tongue to the right, sluggish abdominal and cremasteric reflexes, as well as sluggish pupillar reflexes.

Provisional Diagnosis. Possible intracranial injury; fracture of two ribs posteriorly on the left side; contusion of the region of the left hip joint.

Ear examination, December 12, 1926. Drums are intact. Canals are normal. There is no evidence of injury in either tympanum. The hearing in the right ear is very good to a soft whisper. There is a marked edema and tenderness over the left mastoid. Patient does not hear a forced whisper in the left ear. Patient is totally deaf, left ear to noise apparatus. There is spontaneous nystagmus directed to the right. There is also some vertical nystagmus upwards and to the right. The defect in hearing, the peripheral facial palsy

together with the labyrinthine nystagmus could be explained by a fracture through the petrous portion of the temporal bone involving both the labyrinth and the facial nerve.

December 10. Lumbar tap was done first drawing off about 10 c.c. bloody fluid under markedly increased tension. About 30 c.c. bloody fluid in all was removed under normal tension.

The result of my examination two years and four months later is as follows.

There is no evidence of facial paralysis. The left ear is stone deaf and a mild depreciation of hearing on the right. The pupils are irregular but react to light and accommodation. There is no spontaneous nystagmus, past-pointing or falling and the after-turning nystagmus is shortened for both sides. On rotation to the right he past-points 3 inches to the right with the right and touches with the left. On rotation to the left he past-points slightly to the right with the right arm and 5 inches to the left with the left. Douching demonstrates that there is no response from the left side and the right vertical canals do not respond to prolonged stimulation.

Diagnosis. From the evidence it may be said that this patient is suffering from a complete destruction of the left cochlea and static-kinetic labyrinth due either to fracture of the petrous portion of the temporal bone or laceration of the auditory nerve. In addition, there is evidence that the vestibular pathways have suffered a permanent injury.

Case II. Mr. W. G., twenty-three years of age was first seen on May 5, 1934, complaining of giddiness, difficulty in hearing especially with the right ear and pain in the back on motion.

On December 14, 1933 he fell down an elevator shaft for the distance of 25 feet, landing on his back and the back of the head, more on the right side where he sustained a scalp wound. He did not become unconscious but suffered with vertigo of a systematized character, directly after the injury. This disappeared in two to three days and then he became conscious of difficulty in hearing in the right ear.

Physical Examination. The right eye has an adherent and scarred iris due to previous injury. The left pupil reacts to light. The drums are normal in appearance. He has tenderness over the right mastoid and tenderness on pressure of the muscles extending from the base of the skull and attached to the scapula on the right side. There is no spontaneous nystagmus. He past-points spontaneously with the right arm 1½ inches to the right and touches with the left. In the Romberg position he sways to the right and if his feet remain together he would fall unless he saves himself by spreading his feet apart. He falls to the right, no matter in which position the head is turned. With the horizontal semicircular canals in the horizontal plane, on rotation to the right he develops a rotary nystagmus to the left which lasts nineteen seconds. On rotation to the left he develops a rotary nystagmus to the right which lasts twenty seconds. Also to be noted is that the nystagmus is rotary instead of horizontal. With the vertical canals in the horizontal plane there is no falling after rotation in either direction. On rotation to the right there is no past-pointing with either hand. On rotation to the left he past-points one foot to the right with the right and touches with the left. This direction of past-pointing is opposite to that which is found normally. On rotation to the right there is no after-turning vertigo. On rotation to the left he still feels that he is turning to the left after the chair has stopped. The duration of the after-turning vertigo was twenty-seven seconds.

Diagnosis. Chronic traumatic periostitis of the right mastoid and chronic myositis. The giddiness, hearing loss and abnormal neuro-otological findings are due to injury of brain-stem and cerebellum, more particularly on the right side.

Case III. Miss M. M., twenty-seven years of age, first seen April 5, 1933, complained of pain at the vertex more on the right side and also the forehead. Dizziness has been more or less constant and she feels as though she will fall forward. For the past eight months she has not heard well with the right ear and has tinnitus.

Present History. On November 29, 1932 she was struck on the head by an object weighing about one hundred pounds. She did not faint or fall but about three hours after the injury had a severe epistaxis. Four hours after the injury she vomited.

Physical Examination. There is a slit-like perforation in the right drum, otherwise it is normal. The left drum is normal. There is adiadochocinesis of the right hand. There is no

spontaneous nystagmus or past-pointing. The pelvic girdle reactions are not prompt. There is a marked tendency to fall forward or backward on slight propulsion. The hearing on the right side is markedly depressed, particularly in the upper half of the tone scale. The hearing on the left side is moderately diminished. On rotation, the head became loose on the neck so that it rolled on the shoulders as the rotation was being performed. There was no nystagmus after rotation, but rotation was followed by marked dizziness. On rotation to the right she past-pointed slightly to the right and touched with the left. On rotation to the left she past-pointed 3 inches to the left with the left and touched with the right. Because of the peculiar lack of tonus in the muscles of the neck the examination was discontinued at the insistence of her mother.

Diagnosis. Because of the incompleteness of the examination the only deduction that can be made is that this patient suffered an injury to the pathways which convey impulses to the muscles of the eye. In other words the vestibulo-ocular reflex had been abolished. It is likely also that she sustained an injury to the pathways which lead to and from the cerebellum or the cerebellar nuclei particularly on the right side. It is doubtful whether this patient will ever be able to work at an elevated positon as her unsteadiness will make her liable to injury by falling.

Case iv. Mrs. A. K., forty-seven years of age was first seen June 28, 1932. June 17, 1932, her car was hit by another, she became unconscious and awakened in an ambulance. Her lower limbs were paralyzed for three hours and then she was able to walk. There were bruises and cuts on her head and body. Since the accident she cannot hear well and her memory has become poor. She does not remember having had trouble with her ears prior to the accident. She has dizziness and at times has a sensation of falling. In addition to this she complains of constant headache and some difficulty in seeing. Except for falling on attempt to overthrow backward, there are no spontaneous symptoms. Rotation reveals normal vestibulo-ocular responses from stimulation of the horizontal canals. There is slight falling after rotation with the vertical canals in the horizontal plane. On rotation to the right in this position, severe vomiting occurred. Slight vertigo and no vomiting was experienced on rotation to the left in this position. The past-pointing was shortened in extent and duration, but the direction was normal on both sides. There was a moderate bilateral loss of hearing throughout the tone range. Both air and bone conduction were shortened.

Summary. Abnormal pelvic girdle reaction on pushing backward; bilateral, mild hearing loss; reduced reaction to rotation of the vertical semicircular canals; and past-pointing diminished as to extent and duration on both sides.

Diagnosis. Injury to brain stem and cerebellum.

Prognosis. Condition is permanent and likely to become worse.

This patient returned on October 22, 1935, three years and four months after the first consultation, complaining of progressive loss of hearing, dizziness, unsteadiness and repeated headaches. The hearing loss is much worse than on the previous examination (see audiograms, Figures 1 and 2). The air and bone conduction remain shortened. The fundi are normal. There is a defect in the left pupil which has been present from birth. There is a spontaneous nystagmus to the right on looking to the right, and a tendency to fall to the right in the Romberg position. This falling is not influenced by change in position of the head. With the eyes closed and the feet spread apart on pushing backward she falls backward. On pushing to the left she sways to the left and falls to the right. On rotation with the horizontal canals in the horizontal plane, the nystagmus is normal from both sides. The after-turning vertigo is shortened as to the duration, but the direction is normal on both sides. On rotation with the vertical canals in the horizontal plane, the falling is slight and the direction is normal. The past-pointing after rotation to the right is 1½ feet to the right and absent on the left. The past-pointing after rotation to the left is 8 inches to the left with the right and 4 inches to the left with the left. On douching the right ear with the horizontal canals in the horizontal plane, a fine horizontal, rather than a rotary, nystagmus to the left of thirty seconds duration is obtained. With the head back the nystagmus is large, horizontal, and to the left. On douching the left ear with the horizontal canal in the horizontal plane, the nystagmus is large, rotary to the right of twenty seconds duration. With the head back, the nystagmus is large, horizontal,

and to the right. On douching the right ear no past-pointing is elicited with the right arm. The left arm past-points slightly to the right. No past-pointing is produced after douching the left ear.

Summary. Since the examination of over three years ago, there has been a marked change for the worse in the neuro-otological picture, namely, spontaneous falling, abnormal pelvic girdle reactions, spontaneous nystagmus, a perverted nystagmus after douching the right ear and markedly reduced reactions to past-pointing from stimulation to both sides. There has been a marked increase in the hearing loss.

Diagnosis. The original diagnosis is confirmed and the prognosis as to the permanency of the condition strengthened.

CONCLUSION

It has been shown that head injuries accompanied by commotio cerebri have as their symptoms, among others, disorientation and impairments of hearing.

Paralysis of cranial and perepheral nerves is common when the injury is of a more severe degree.

The disturbances of function of the auditory and static-kinetic end-organs are not as common as injuries to the pathways that lead to the brain stem and cerebellum.

The effects of injuries to the brain stem and cerebellum are permanent and are likely to become worse in time.

A worker who has sustained a head injury is likely to fall from elevated and unprotected positions because of giddiness and instability.

REFERENCES

1. Wilson, J. Gordon. *Arch. Otolaryngol.*, 11: 3, (March) 1930.
2. Gottlieb, Mark J. *Laryngoscope*, (Oct.) 1922.
3. Lithicum, Fred H. and Carl W. Rand. *Arch. Otolaryngol.*, 13: 6, (June) 1931.

EDEMA OF UPPER EXTREMITY IN CARCINOMA OF MAMMARY GLAND

ITS PREVENTION IN SOME CASES

JOHN J. GILBRIDE, M.D.

Formerly Assistant Professor of Surgery, Medico-Chirurgical College and University of Pennsylvania

PHILADELPHIA

THE lymphatics constitute one of the big problems in malignant disease. The lymphatics of the mammary gland are of special interest and importance in carcinoma of the breast because of their wide distribution and communication with the lymphatic system through (1) the axillary nodes, (2) the perforating vessels of the anterior chest wall, (3) other vessels in relation to the sheath of the rectus abdominalis muscle to the epigastric triangle and the peritoneal cavity and (4) the lymphatic communication with the opposite breast.

Metastasis of carcinoma of the breast may take place by way of any of these routes, but the most frequent course is to the axillary nodes. Most of the lymph from the breast passes to the axillary nodes and it is in these nodes which are accessible, especially in thin individuals, to the palpating fingers that we feel for any early signs of manifestation that the disease has passed beyond the limits of the breast.

An absence of palpable axillary nodes in the presence of disease of the breast does not mean necessarily that these nodes are free from invasion. And, also, it may be said that even though the nodes may be palpable one cannot state positively that the nodes are the seat of malignant disease. Palpable axillary nodes associated with a definite diagnosis of carcinoma of the breast are to be regarded almost always as invaded by the malignant process.

Edema of the upper extremity is associated with 20 per cent of advanced cases of carcinoma of the breast, and it occurs in 10 per cent of patients on whom radical breast operations have been performed. The edema in the advanced and inoperable cases is caused by extensive carcinomatous invasion of the lymphatics of the axilla and the subcutaneous tissues of that area. In the early stage of edema the lymph is usually confined within the lymphatics, but later as the disease progresses the lymph escapes into the surrounding tissues with extensive fibrous connective tissue formation.

There may be in a few instances an associated venous stasis in the upper extremity when the diseased axillary nodes compress the axillary vein, or when that vein has been injured during the performance of the operation.

The degree of edema varies and may be limited to certain regions of the upper extremity depending on the invasion or destruction of regional lymphatics. Where the edema is caused by the malignant disease it is progressive.

The superficial lymphatics in the forearm and arm are separated from the deep lymphatics by the deep fascia. The lymphatics from the anterior and inner regions of the hand and forearm pass to the epitrochlear nodes and then to the axillary nodes. The lymphatics from the outer and the posterior areas of the hand, forearm, and some from the arm pass to the pectero-deltoid nodes in the depression between the deltoid and the pectoralis major muscle. These lymphatics continue to accompany the cephalic vein in its course and the lymphatics join the nodes in relation with the costocoracoid membrane, and these latter nodes have connections with the supraclavicular and the inferior cervical nodes. The lymphatics of the outer and

posterior areas of the arm, and also most of the lymphatics in the region of the shoulder join the subscapular nodes.

The lymphatics from the anterior and the posterior regions of the breast are closely connected with the lymphatics in the sheath of the pectoralis major muscle and it is necessary to remove this muscle except the part that arises from the clavicle. In some cases the lymphatics from the upper part of the breast pass directly to the cervical nodes in the anterior triangle of the neck, or they connect directly with the supraclavicular nodes. The system of communication of the lymphatic vessels between the two breasts are connected by a plexus located in the midline of the body.

The arrangement of the axillary nodes is variable. Cheatle and Cutler state,

> the axillary lymph nodes are about twelve in number and they are arranged in four sets. A median set three or more in number along the course of the axillary artery and vein. An inner or anterior set, four or five in number situated below the great pectoral muscle in the course of the long thoracic artery on the outer surface of the serratus magnus (pectoral nodes). A posterior or external set, usually two in number, situated along the course of the subscapular artery under cover of the latissimus dorsi muscle (subscapular nodes). A superior set, usually two in number, situated just below the clavicle close to the cephalic vein upon the costo-coracoid membrane in the fossa beneath pectoralis major and deltoid muscles (subclavian or infraclavicular nodes).

The time of onset of invasion of the lymph nodes in carcinoma of the breast varies greatly. The nodes are, of course, invaded for a considerable period of time before they are palpable. In some instances in the presence of a highly malignant tumor the nodes may be palpable very early. Then there is the slow growing tumor, which usually occurs in elderly women, and the tumor in which the connective tissue predominates, which may not give rise to metastasis for one, two or three years.

The upper and outer or axillary zone is the most frequent site for carcinoma of the breast. Therefore, when the axillary lymph nodes are invaded by emboli, and the disease has extended by permeation of the lymphatics of the skin and the subcutaneous tissues there may be an early edema of the surrounding skin over the diseased area of the breast, edema of the breast itself, or lastly, edema of the upper extremity. The edema may exist separately in any of those areas. Demonstrable carcinomatous invasion of the skin for a distance of 5 cm. or 7 cm. beyond the periphery of a tumor that would be otherwise operable is a contraindication for operation.

Edema of the upper extremity that occurs following radical operation on the breast may be caused by (1) incomplete removal of carcinomatous invaded lymph nodes and diseased skin with the subcutaneous tissues, (2) complete removal of the lymphatics of the axilla and the associated nodes, or (3) the result of lymphatic obstruction caused by tissue scar contraction following a badly placed incision, one that falls within the axillary space and which is the most frequent cause of edema of the upper extremity whether the radical operation was performed for malignant or benign disease of the breast. An error in diagnosis or lack of investigation was responsible for the benign cases.

Figure 1 shows the type of incisions, in only their upper extremity, that are more frequently associated with edema of the upper extremity. *A* extends across the anterior region of the shoulder, and *b* is along the axillary border. Each of these incisions, after the removal of the breast, usually fall, within the axillary space and results in contraction and in many instances, holds the arm close to the thorax. *C* is composed of two incisions, at right angle to each other, and the limb which extends from the clavicle to the axilla is likely to cause lymphatic obstruction. The incision is in a measure subject to the condition found in the breast, but in opera-

tive cases the operator has a choice of location of the incision.

Figure 2 (*d*) is placed traversely and

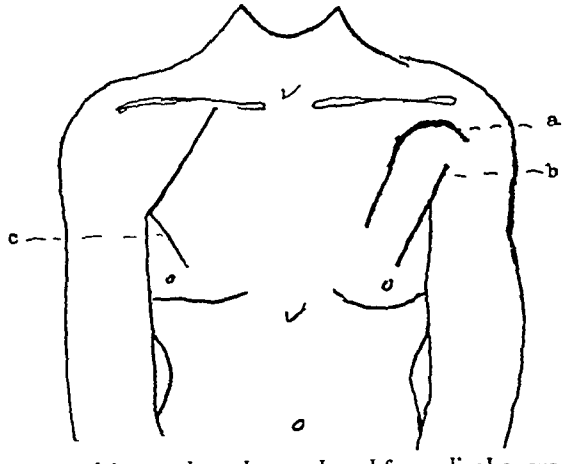


Fig. 1. Incisions *a*, *b*, and *c* employed for radical operation on the mammary gland are those most frequently associated with edema of the upper extremity. Incision *a* extends over the anterior surface of the shoulder, *b* and *c* fall into the axillary space.

least likely to cause lymphatic obstruction, and at the same time by retraction of the incision the lymph nodes can be removed. Incision (*e*) is placed slightly oblique from the breast to the infraclavicular region and will permit ready access to all regional lymph nodes.

Some of these scars, although they may not cause edema of the arm, are often the cause of a crippling impairment of arm function. Operations performed on the breast in which efforts have been made to preserve arm functional movements have given great comfort to many of these women.

The detection of a tumor in the breast is an indication for a prompt investigation. Roentgen ray examination of the breast furnishes most valuable information whether for the purpose of diagnosis, as an aid to a proposed operation, or to determine the operability, the presence of metastasis, and finally for the employment of roentgen ray treatment. A roentgen ray study should include an examination of the other breast. Transillumination of the breast, a method introduced by Cutler, is another important aid in breast diagnosis.

There remains another procedure, surgical exposure and examination of the tumor, for the surgeon to employ in cases which

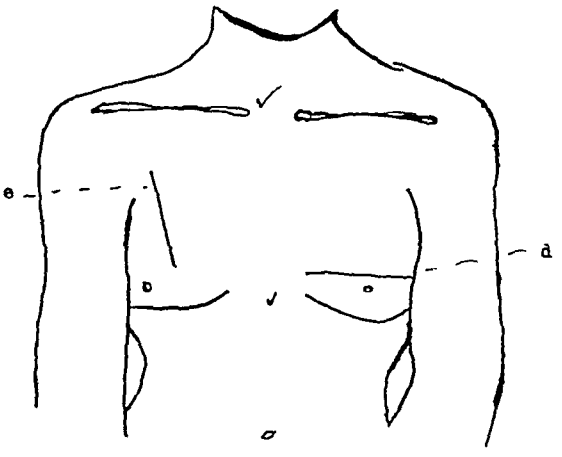


Fig. 2. Incisions *d* and *e* when employed for radical operation on the mammary gland are rarely followed by edema of the upper extremity. Incision *d* has for its center the mammary tumor, and the oblique incision *e* does not encroach on the axillary structures. Incision *d* is transverse.

have not been definitely diagnosed by the aforementioned method.

The patient is prepared for operation and an anesthetic for the extirpation of the entire tumor if that only is necessary or for a complete radical operation when indicated. The surgeon can often decide the diagnosis of the tumor, but in some of these early cases and for lymph node involvement the services of a trained pathologist are absolutely essential. For examination and diagnosis the tumors of the anterior part of the breast or those just beneath the skin are usually exposed by an anterior incision. Tumors within the gland or those that occupy the posterior part of the organ may be exposed preferably by an incision parallel with and through the inframammary sulcus. Further operative procedure will depend on the diagnosis that has been reached.

A better selection of cases for operation by a thorough study of each individual patient, with avoidance of radical operation in patients with benign disease of the breast, and by planning the incision so that it will not fall within the axillary space

comprise measures which will lessen materially the occurrence of edema of the upper extremity. Furthermore, an operation that will convert an ambulant patient into one that is likely to become housefast and in some instances bedfast should not be performed.

SUMMARY

Edema of the upper extremity occurs in 20 per cent of cases of advanced carcinoma of the mammary gland, and in 10 per cent of cases following radical operation for this disease. The edema following radical operation may be caused by previous malignant invasion of the tissues, or it may be due to a badly placed incision, namely, an incision that produces obstruction of the lymphatics from the upper extremity. Incisions with scar tissue contraction that fall within the axillary space are the most frequent cause of edema of the upper extremity. A large number of cases of edema of the arm have occurred as a result of radical operations that have been performed for benign disease of the breast. A careful study of all cases of tumor of the breast, and a planned incision for each case should help to lessen the number of cases of edema of the upper extremity following operation on the mammary gland.

TREATMENT OF CARBUNCLE WITH SHORT WAVE DIATHERMY AND CAUTERY PUNCTURE*

MORRIS FELLMAN, M.D.

Attending Surgeon, Jersey City Medical Center

JERSEY CITY, N. J.

THE fact that striking symptomatic relief occurred, the clinical course shortened and apparent systemic complication avoided has prompted this report on the use of short wave diathermy and cautery puncture in the treatment of 3 cases of carbuncle of the neck. In 2 of the cases, despite the actual inflammatory lesion, pain was the chief complaint and the reason for admission and its relief within thirty minutes after the application of the high frequency therapy without the use of sedatives is worth remarking.

Although some investigators have claimed certain specific biologic or bactericidal actions for short wave, its thermal properties only were the basis for use in these cases. The frequently mentioned contraindication in acute non-draining infection was also kept in mind and to meet this condition the use of cautery puncture to convert the non-draining into an externally draining cavity was adopted. In addition, the cautery was selected so that all vascular supply would be sealed off and the possibility of open blood spaces that might occur with incisions was eliminated.

It is known that high frequency currents avoid mechanical and chemical effects but have the ability to heat body tissues through which they pass. Physiologically this results in the opening of large numbers of capillaries and the increase in the rate of the blood flow through the capillaries. The acceleration of tissue metabolism is procured and there is an augumentation of the rate of exchange between blood and tissue.

The 3 cases presented lesions of the type that could have been treated in one of the three following ways; (1) excision by either scapel or electrosurgery under general anesthesia; (2) cautery puncture under general anesthesia followed by hypertonic wet dressings or the application of heat; (3) the use of bacteriophage, particularly if a bacterial strain of Staphylococcus aureus or albus is present. All the carbuncles had the usual brawny consistency studded throughout with numerous pinpoint spots exuding pus, but with no definite fluctuant areas.

The technic of the treatment is as follows. A cable is attached to the short wave machine and is given three turns at the center so as to form a circle, large enough to extend beyond the margins of the lesion. Several thicknesses of toweling are placed over this and the patient is instructed to lie down in such a manner that the carbuncle occupies the center of it. The current is turned to the point of comfortable heat tolerance and the treatment is kept up for fifteen or twenty minutes either once or twice in twenty-four hours.

The carbuncle is carefully inspected each day and as soon as any point of fluctuation is seen this is drained by puncturing with the actual cautery. No anesthesia is required as the tissues at this spot are usually so insensitive or desensitized that the patient scarcely perceives the cautery thrust. The fact that anesthesia is not necessary is important because carbuncles usually occur in old persons, frequently debilitated, and often diabetic in whom the use of an anesthetic presents a definite hazard.

The clinical courses of the cases forming the basis for this report are as follows:

* From the Jersey City Medical Center.

Case I. J. T., aged fifty-six years. One week before admission he noticed a pimple on the back of his neck which he scratched and within twenty-four hours a physician considered it advisable to incise. Notwithstanding this treatment the condition became worse so that upon admission to the hospital he presented a hard, indurated area on the back of his neck about 4 inches in diameter. There was bluish discoloration about the margins and a yellow area in the center, still firm but showing numerous small pus-draining points. The pain was very severe. A twenty-minute short wave diathermy treatment was given and in a half-hour he was very comfortable. The next day the center was fluctuant and this was drained by several cautery punctures without anesthesia. The diathermy was continued daily and as additional areas of fluctuation appeared they were punctured. The patient was discharged in thirteen days with the infection entirely cleared and only a faint pink blush to mark its site.

Case II. J. F., aged sixty-three years, complained of a painful infected swelling on the back of the neck for one week continuously increasing in size. There were a few superficial yellow areas which were points of pus ready to discharge spontaneously. The entire part was hard and indurated and measured about 3 inches in diameter. One of the small pus pockets was punctured and the culture showed Staphylococcus aureus. A short wave diathermy treatment was given at once and repeated the next day. In thirty-six hours the center area was ready for cautery puncture. This was repeated when indicated and the patient was discharged in twelve days with the infection cleared. The relief of pain soon after the first treatment was mentioned by this patient.

Case III. I. N., sixty years of age, complained of an abscess on the right side of the neck about 4 cm. in diameter for the week previous to admission. He gave a history of diabetes for eight years with irregular periods of proper supervision. When admitted he showed a moderate amount of glycosuria which at the start required ten units of insulin three times daily, gradually diminishing. Thirty-six hours after the short wave diathermy, this lesion ruptured spontaneously and did not require cautery puncture. He was discharged in one week. There was slight redness and induration but no fluctuation or pus exudate and the reason he left the hospital was because he said that he didn't feel "sick enough to stay any longer."

SUMMARY

In the discussion of these cases the ease of application of short wave diathermy as compared with the previous conventional lower frequency diathermy is noteworthy. In addition, another advantage is the comparative comfort with which persons of this age may be treated. This plan of therapy is, therefore, considered a valuable adjunct to management of cases of this type.

ACUTE APPENDICITIS

REPORT OF 757 OPERATED CASES

R. M. POOL, M.D., F.A.C.S.

Assistant Chief Surgeon, Employees' Hospital

FAIRFIELD, ALABAMA

NO apology is made for presenting a paper on acute appendicitis but if any excuse were needed, the apparent increase in the incidence of this disease and its appalling mortality statistics should be amply sufficient. Entirely too many members of our profession are inclined to consider this subject as ordinary and uninteresting and seem to believe that the last word has been said on the subject. We feel, however, that any disease which causes the death of as many persons as does appendicitis warrants most careful study and that a thoroughly conscientious report of a group of cases of this size will not be amiss.

It has been fifty years since Fitz gave the first really comprehensive paper on this subject. Only recently his son has presented another very valuable article, again calling attention to the seriousness of this disease and the need for careful study and consideration by the family physician and internist as well as by the surgeon. Although Osler long ago said, "there is no medical treatment for appendicitis," the general practitioner and internist have a tremendous responsibility in early diagnosis as well as education of the lay public.

Perhaps it may seem unnecessary to mention the essentials of diagnosis, combined with the warning against the use of purgatives and opiates; or to mention the increasing danger of delay after the diagnosis is made. To ignore these things will only invite disaster; to heed them will amply repay every one.

We shall attempt, without being too uninteresting, to present work done at the Employees' Hospital and try to prove that the fatality rate can be lowered.

This report includes: the age incidence, the number of males compared with females, the occurrence in negroes compared with whites and the seasonal incidence. It shows the average hospital stay, and the number of perforated and non-perforated cases. In the perforated group the ones with generalized peritonitis are compared with the ones which had frank abscess formation, giving the fatality rate of each. Brief mention is also made of the cases with and without previous attacks, and a few words seem in order about the type of incision used.

Following the suggestion made by Dr. Donald Guthrie in his editorial in the August, 1935 issue of the American Journal of Surgery, the cases reported in this paper include only cases of *acute* appendicitis. The simple routine appendectomies done while the abdomen was open for some other purpose, as well as simple appendectomies done on interval cases, have purposely been omitted.

A total of 757 cases of acute appendicitis have been operated at the Employees' Hospital since it was opened in November, 1919. Of this number 260 cases were operated by the author.

The age incidence was one of the most interesting things noted, the youngest patient being eight months. This infant had a gangrenous appendix, verified by the pathologist, which was removed at operation for intussusception. The intussusception had included or probably started at the ileocecal valve, and had interfered with the meso-appendix circulation to such an extent that the appendix was completely gangrenous. The circulation in the involved gut was only mildly embarrassed, and after the intussusception was reduced the color of the gut returned to normal, while the appendix remained "blue-black," necessitating appendectomy.

The other extreme in the age group was a patient sixty-six years of age. She recovered from a severe, diffuse, general-

ized peritonitis due to a gangrenous, ruptured appendix; the preoperative diagnosis in this case was intestinal obstruction.

The age incidence in this group supports what is generally known, that acute appendicitis is a disease of young adults. The incidence according to decades of life was as follows:

TABLE I

Age groups	Cases	Deaths
1–10	81	9
11–20	313	7
21–30	210	12
31–40	102	7
41–50	33	8
51–60	16	2
61–70	2	0

The average number of days each patient stayed in the hospital was fifteen. This may seem longer than necessary or longer than the average for an ordinary abdominal operation, but there were a number of drainage cases with unusually long hospitalization, which lengthens the average. It has been our custom to keep these patients until they are ambulatory, and it is not our policy to send them home in the ambulance in four to five days. Two weeks is a long time, but it is during this period that most complications arise.

An overwhelming majority of cases occurred among the white people as compared with the negroes. There were 602 white cases of which 411 were males and 191 females; and of 155 negro cases 127 were males and 28 females.

The small number of cases of acute appendicitis among the negroes was very noticeable. We are searching for some explanation. To simply state the occurrence among the whites and among the negroes does not express the situation clearly. The normal capacity of the Employees' Hospital is 310 beds, and the average daily census of whites compared with negroes is approximately equal, or 50 per cent of each.

The admissions were from a limited territory and represented families of individuals who were on the payroll of the Tenessee Coal, Iron and Railroad Company. The estimate of whites and negroes in the employment of the Tennessee Coal, Iron and Railroad Company is about 60 per cent negroes and 40 per cent whites. In the Mining Department there is a much larger percentage of negroes; a reasonable estimate being about 70 per cent negroes and 30 per cent whites. So it is not difficult to see that this emphasizes the low percentage of occurrence of acute appendicitis in the negroes compared with the whites.

There have been several theories submitted in explanation of this low occurrence among the negroes, one being that the negroes are much more attentive to their elimination and that constipation favors stasis in the cecum as well as in the colon, and stasis favors infection. Indirectly, the original inflammation may be aggravated by improper elimination. Another favorite explanation advanced by others is that the diet of the negro is decidedly different from that of the white man. Very few negroes have the abundance of food that most white people have, and very few "live out of tin cans" to the extent that white people do. This is only advanced as a vague theory, and the explanation of the sequence of the physiological and pathological changes which occur in the appendix due to diet are not attempted here.

The seasonal incidence is not often commented, and while we have no reasonable or logical explanation for the seasonal occurrence, acute appendicitis certainly does seem to be a disease of the summer months. This might be expressed in another way and attention is called to the fact that the months in which the greater number of cases occurred were the months *following* the winter months. Table II shows the occurrence by months.

There was a history of previous attacks noted in 222 cases and no previous attacks in 535 cases. This may not be an accurate description of the occurrence of previous attacks because in the history unless the fact was mentioned that the patient had

TABLE II

Month	Cases	Deaths	Fatality Rate
January	63	2	3 17
February	56	3	5 35
March	47	3	6 38
April	86	6	6 97
May	71	5	7 04
June	90	5	5 55
July	80	2	2 50
August	80	4	5 00
September	53	4	7 54
October	40	4	10 00
November	50	3	6 00
December	41	4	9 75

had previous attacks that case was included in the group without previous attacks.

Two-hundred twenty-four patients, or 29.59 per cent of the total cases, showed gross perforation of the appendix at the time of operation. The high percentage of perforations deserves further comment. The statistics covering this group of cases fail to give absolutely accurate information concerning early purgation. No doubt any other member of the Surgical Staff will agree that at least 75 per cent of the cases of perforated appendicitis had had early purgatives prior to admission. The medical set up in the Tennessee Coal, Iron and Railroad Company gives the employees easy access to the local physician and the people take advantage of this service. These physicians are competent men and know full well the danger of purgatives in any type of acute abdomen and do not prescribe purgatives. The laboring classes, who make up a large majority of the employees of the Tennessee Coal, Iron and Railroad Company, are naturally the type of people who think any kind of abdominal pain can be relieved by purgatives. This, of course, is gross ignorance and is responsible for the self administered purgatives to which so many of the perforations are due. Each member of the Medical Department of the Tennessee Coal, Iron & Railroad Company is continually preaching against purgatives in questionable abdominal cases; and it is hoped that this paper will at least be stimulating to further educate the lay public along this same line.

Of these 224 perforated cases there were 48 cases of generalized peritonitis with 26 deaths, a percentage of 54.15, and 32 cases of localized abscess, with 3 deaths, a fatality rate of 9.37 per cent.

By the term "generalized peritonitis," as here used, we indicate a true purulent spreading peritonitis, with the presence of frank pus over a wide area with marked injection of all visible peritoneal surfaces.

Cases of gangrenous or suppurative appendicitis, with or without perforation and with varying collections of different types of intraperitoneal fluid, often of a purulent nature but without marked injection or exudate of peritoneal surfaces, are not included in this classification. Intraperitoneal drainage was employed in 363 cases, or in all of the 224 frank perforations, and in an additional 139 cases where bacterial penetration from a necrotic appendix was suspected.

Of recent years we have followed the general trend toward less drainage, although we are far from accepting in full the opinion of Arthur Shipley, leaning rather to a midpoint between his teaching and that of Lawson Tait, whose famous rule "when in doubt drain" has, we believe, saved many lives. We believe Guerry's statement "that Tait's rule: 'when in doubt drain' changed to 'when in doubt don't drain' may be witty after a fashion but is vicious as a surgical principle" is worth remembering. We have, of course, closed without drainage many cases of the gangrenous or suppurative type with varying amounts of serous fluid in the abdominal cavity, often with plastic exudate on the appendix.

When drains are used the soft Penrose type or the so-called cigarette drain is preferred, usually two being passed into the pelvis, care being taken to keep these drains lateral to the intestinal coils. In severe cases one or two drains are passed upward toward the liver.

The question of delayed operation must be touched. We all appreciate the futility of a few drains when the entire abdominal

cavity is involved in a spreading infection. Any type of drain functions in a very circumscribed area for a very limited period. In a desperately ill individual with a history of acute illness of more than thirty-six hours duration, board-like rigidity of the abdomen, vomiting, dehydration, rapid pulse, leucocytosis, anxious expression and semicollapse, is not conservative and supportive treatment indicated in the hope of abscess localization and a delayed simple drainage operation?

We believe that the figures presented previously: 54 per cent fatality in cases of spreading peritonitis subjected to operation, as against 9 per cent fatality in drained abscess cases, is part of the answer at least. In connection with the increase of abscess cases, with a decrease of the generalized peritonitis cases, the fatality rate is correspondingly low in the entire group over the period where the spreading generalized peritonitis cases were treated by supportive measures and a delayed operation.

In 1930 Dr. Groesbeck Walsh and I reviewed the cases of acute appendicitis which had been operated up to that time. We were surprised and disappointed to find that there had been 35 deaths of 500 cases, a fatality rate of 7 per cent. We realized that this was too high and recently in bringing this summary up to date, that is to September 1, 1935, with the addition of 257 cases, we were interested to find that there had been only 10 deaths, which gives a fatality rate of only 3.9 per cent. Of these 757 cases there were 712 recoveries and 45 deaths, or a fatality rate of 5.94 per cent.

Is there any reasonable explanation for this improvement? We believe that there is no one individual thing which can be given credit for this decrease in the fatality rate. The following things no doubt play an important part and when combined will probably give the correct answer to this question.

First of all we feel that there is a closer cooperation between the medical and surgical services and no doubt a large part of this improvement in the fatality rate is due to the careful preoperative consideration that is given these patients, not only towards making a diagnosis but also as to the operability and the risk to the patients as estimated by the Medical Service. We appreciate their cooperation, and there is no doubt that the patient has been greatly benefitted by this preoperative consideration. This, of course, leads to a more accurate diagnosis.

We feel too that the early hospitalization of these patients has helped, because now, contrary to the first few years when the hospital was opened, the vicinity that we serve is more localized. Formerly there were patients brought from a larger territory. Now the concentration of the industrial works in a closer neighborhood has facilitated the transportation of these sick patients at a more rapid rate. We feel that this has not only given earlier hospitalization, and thereby earlier operation in the unruptured cases, but also has made correct recognition of the generalized peritonitis cases easier, and has aided in giving conservative and supportive treatment which facilitated localization of the infection into abscess formation and surgical intervention at the optimum time, usually drainage only.

We also feel that a better understanding of the need of the patient after operation has aided in reducing the fatality rate. We believe that special care should be given to the fluid intake, the prevention of gastric dilatation, and the prevention of absorption from the stomach and upper intestinal tract by the use of the inlying duodenal tube, with the suction apparatus attached, as advocated by Wangensteen and also by Bartlett. We favor, too, as a postoperative measure, especially in those cases that show some peritoneal soiling, heat to the abdomen, either by coop light, electric pad or hot water bottle. We believe, also in the generous use of morphine, which does not allay peristalsis as was formerly thought. This has been definitely proven by Oschner and Gage.

As time passes and more of these cases come under our observation, we believe that considerable improvement in handling them is helping to reduce the fatality rate. We hope that our judgment about when to operate and what to do at the time of the operation has improved with experience. We will continue to make every effort toward early and correct diagnosis, early operation in the unruptured cases and continue conservative treatment and delay operation in the generalized peritonitis cases, thereby obtaining even a lower fatality rate than that quoted.

A paper of this kind, dealing with a definite pathological entity, would not be complete without some mention as to the type of incision used. A large majority, in fact practically all of these cases, were operated through a McBurney incision. Occasionally this incision had to be enlarged which, contrary to generally accepted opinion, is a most simple procedure, and there can be no question that ease of access thus secured is most valuable. There are several reasons for this. First of all we feel that the abdominal wall is much stronger afterwards, as compared with the case that is opened by the use of a rectus, Douglas, Kamerer, Battle or any of the other standard incisions that do naturally afford more room and perhaps easier exposure. These other incisions allow more abdominal contamination by permitting more loops of small gut to come into the field and become contaminated if the appendix is ruptured.

It is probably unnecessary to mention the increase in the number of incisional hernias that occur in the incisions aside from the gridiron. We have had a number of gridiron drainage cases with wound suppuration that have failed to show any muscular defects or herniation after a good many years. We consider also the class of patients in which most of these cases occurred and realize that they must return early to active manual labor. This is certainly easier and quicker in the cases that were operated through a McBurney's incision. We hope that this incision is not mistaken for what is commonly called a "button-hole" incision. We believe that easy access is usually obtained through a gridiron but not through what is commonly called a "button-hole." If the case is one for drainage we believe that lateral drainage and drainage from the pelvis and right iliac fossa is definitely facilitated by use of a gridiron incision.

We feel quite certain that some will disagree with part and perhaps with all of this presentation. It is realized that every man has a right to his own opinion. It is human nature to forget the bad results, and also quite natural to remember the successes. No doubt if any of you would make a similar summary of your own cases you would be surprised at the number and also the results.

As a closing thought it is suggested that we all study our figures and become better acquainted with our results and let that information stimulate us to a definite effort to improve those results.

SUMMARY

The fact that acute appendicitis is considered ordinary and uninteresting might be partly responsible for the fatality rate, which is certainly too high.

This report includes only cases of acute appendicitis and gives the age incidence, the number of males compared with the females, the occurrence in negroes compared with whites, the seasonal incidence, the average hospital stay and the number of perforated and non-perforated cases.

In the perforated group those with generalized peritonitis are compared with the ones which had frank abscess formation, giving the fatality rate of each. Definite evidence is presented to show that the cases which are allowed to form an abscess have a much better prognosis after operation than those cases operated with a spreading generalized peritonitis.

Reasons are given for our preference in using a McBurney incision.

Due credit is given the members of the medical service for their helpful cooperation.

ADEQUATE SURGICAL MASKING: PROBLEM AND SOLUTION

EDWARD G. WATERS, M.D., F.A.C.S.

Attending Surgeon, Christ Hospital; Division Chief of Obstetrics, Margaret Hague Maternity Hospital

JERSEY CITY, N. J.

THE pathway of aseptic surgical technic since the work of Pasteur in 1879 has led to the efficacy and end results of modern surgical endeavor. The trail has been a long and winding one and the greatest advances have been made in technical steps which were not always unresisted. The sterilizing of instruments, the thorough cleansing of hands, the use of first clean and then sterile garments to replace street clothes in the operating room, the meticulous preparation given the region to be handled and the use of rubber gloves, are all steps whose necessity we immediately recognize and accept. But when first proposed, they were not immediately granted their importance as witness the tardy acceptance of Halstead's introduction of rubber gloves in 1890, unquestionably one of the most important contributions.

The sources of operating room wound infection are the operating staff's hands, instruments, garments, materials such as sutures used in work, and nasal and oral droplet spray. The progress of surgery is dependent upon heeding the words of Sir Berkeley Moynihan,

> Every operation in surgery is an experiment in bacteriology. The success of the experiment . . . depends not only on the skill but also upon the care exercised by the surgeon in the ritual of the operation. The ritualist must not be a man unduly concerned with fixed forms and ceremonies . . . but one who refuses to be merely a mimic bound by custom and routine. He must set endeavor in continual motion, and seek always and earnestly for simpler methods and a better way.

With one exception, the sources of infection in the present day operating room are well controlled, that exception being nasal and oral droplet spray infection.

An attempt at control is made through the use of face masks, usually made of gauze. Their efficiency has been seriously questioned within recent years, and the studies of Walker and others indicate that here is a patent defect in modern operating room infection control. His investigation shows that wound infections of a Streptococcus hemolyticus nature occur with epidemics of respiratory disease and that at such times 50 per cent of operating room personnel are hemolytic streptococcus carriers. Further, that the usual gauze masks are totally inefficient and that proper masking practically eliminates hemolytic streptococcus infections. Kellogg and MacMillan found that the efficiency of the gauze masks depends upon the number of layers and fineness of mesh of the gauze. When one of sufficient density was used to exert a useful filtering influence, breathing became difficult and there was leakage at the edge. The efficiency of the gauze mask seldom exceeded 50 per cent. While Meleney showed that streptococcus carriers are most commonly met in epidemics of respiratory diseases, it is now generally accepted that they may be encountered at any time of the year. Writing on the same subject, Davis is of the opinion that an operating surgeon is not justified in omitting a single precaution for the patient when operating, and stresses inadequate masking as the weak link in the chain of operating room technique. He lists for his requirements for adequate surgical masking, a mask of impervious material which completely blocks the mouth, chin and nostrils, deflects breath spray away from the wound and is well fitting over the nose to prevent fogging of glasses.

The writer's attention was directed to the matter of adequate masking by a series

of wound infections which were traced to an assistant who was a nasopharyngeal streptococcus carrier. A repetition of Walk-

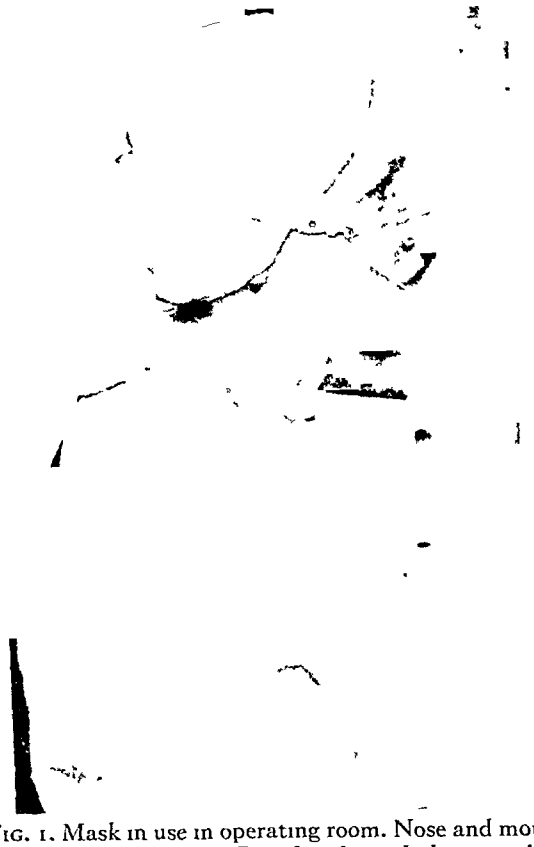


Fig. 1. Mask in use in operating room. Nose and mouth completely occluded. Rim fitted snugly but not tight over nose; tape drawn straight back over ears to prevent mask from "riding" up on the nose.

er's experiments on the transmissibility of infection through the ordinary gauze mask corroborated his notation of its inefficiency. It was also noted that many surgeons and assistants did not cover the nose, because of the personal discomfort, steaming of glasses, interference with speaking and the like. It is obvious that improper masking is little better than none. The surgical aseptic conscience must be developed fully by the surgeon himself if he would expect adherence by other members of the team to the essential carefulness upon which success depends.

Maes indicates the need of improved masking when he states that "when a fatal outcome may follow a pin prick it is obvious that the surgeon incurs serious responsibility . . . even tho every instrument is sterilized, tho in his modern operating garb he *scarcely breathes upon* his patient, and tho he touches him only thru the interven-



Fig. 2. Mask adjusted for nursing mother in upper respiratory infection prophylaxis.

tion of rubber gloves." There is no more justification for "scarcely breathing" upon a wound than there is for continuing to use a torn glove. The jeopardy is to the patient and the surgeon has no moral right to permit its existence.

The search for a mask to fulfill the requirements of the operating room as outlined by Davis culminated in the following: A mask is made of a transparent, impermeable, light weight, non-combustible substance, a cellulose derivative called "Plastacele," the upper edge of which is wedged in a pliable aluminum band in order that it might be bent to fit the shape of the wearer's nose. It is held in place by ear pieces, or cotton tapes tied around the head, in the usual manner of tying masks. That part coming under the chin is so shaped as to catch perspiration drops.

This device was tested with smoke and vapor to determine inspiratory and expiratory breath currents. It was found that most of the inspired air entered from about

the chin, while the expired air was deflected backward past the cheeks and ears. Using Walker's technic the impermeability and deflection of expiration was tested on nine persons, three of whom harbored streptococci in the mouth and nasopharynx.

A protecting box was made 18 inches high and 30 inches long, with a central transverse occluding partition for the culture plates. One open end was used for the test, the other for the controls. Three blood agar plates were placed 18 inches away from the subject at the test end, and three were placed at the control end. Reading aloud from a book for sixty minutes constituted the test, and one test and one

TABLE I

TALKING TEST—6 SUBJECTS USING 4-PLY GAUZE MASKS. NOSE AND THROAT CULTURE NEGATIVE FOR STREPTOCOCCI

	15 Min.		30 Min.		60 Min.		Number of Colonies Averaged in Controls		
	No. Positive	No. Colonies	No. Positive	No. Colonies	No. Positive	No. Colonies	15 Min.	30 Min.	60 Min.
Streptococcus hemolyticus	0	0	1	3	1	4	0	0	0
Staphylococcus aureus	2	4–7	4	8–12 14–17	5	12–12 13–9–8	2	5	4
Staphylococcus albus	0	0	4	9–5–8 11	4	10–12–8 14	0	6	7

TABLE II

TALKING TEST—3 SUBJECTS USING 4-PLY GAUZE MASKS. ALL STREPTOCOCCUS HEMOLYTICUS CARRIERS

	15 Min.		30 Min.		60 Min.		Number of Colonies Averaged in Controls		
	No. Positive	No. Colonies	No. Positive	No. Colonies	No. Positive	No. Colonies	15 Min.	30 Min.	60 Min.
Streptococcus hemolyticus	1	5	3	12–16–6	3	19–18–14	0	0	0
Staphylococcus aureus	2	9–3	2	10–15	3	23–17–12	3	4	6
Staphylococcus albus	0	0	2	12–9	2	14–19	0	5	4

TABLE III

TALKING TEST

9 SUBJECTS (6 NORMAL, 3 STREPTOCOCCUS HEMOLYTICUS CARRIERS)

TESTS MADE USING NEW IMPERVIOUS MASK

	15 Min.		30 Min.		60 Min.		Number of Colonies Averaged in Controls		
	No. Positive	No. Colonies	No. Positive	No. Colonies	No. Positive	No. Colonies	15 Min.	30 Min.	60 Min.
Streptococcus hemolyticus	0	0	0	0	0	0	0	0	0
Staphylococcus aureus	1	2	2	1–3	2	2–2	3	2	5
Staphylococcus albus	0	0	2	3–3	3	2–2–4	1	4	5

control culture plates were removed simultaneously in fifteen, thirty and sixty minutes.

The first group series was run with the subject using four ply gauze operating room masks, the second using the impervious mask described.

The results of the first group are given in the tables. In the second, employing the new impervious mask, *there were no instances where the test plates showed colonies in excess of the control plates.* There were no hemolytic streptococcus growths in any of the test plates where the new mask was employed.

The absence of blood-agar plate contamination with the new impervious mask is strikingly demonstrated, in contrast to the results obtained with the gauze mask. These demonstrate the most important feature, the protection of the patient.

Some lesser advantageous features became apparent during the experimental use of this mask. There was neither steaming of glasses nor fogging of vision, the face could be seen, facial expressions noted and words heard clearly. Constant wiping of perspiration from the face and neck is unnecessary, for readily replaceable pledgets of absorbent cotton one inch square in the "floor" of the mask suffice to prevent contamination of the sterile field. It is readily cleansed in soapy water, sterile water or the ordinary aqueous solutions of antiseptics. It is inexpensive in continual use for its durability makes its life dependent upon the ordinary handling it receives. In operation, its cost over its lifetime approximates the inefficient permeable gauze masks in common use. When put on and adjusted properly, it is found to be most comfortable when used over long periods of time.

CONCLUSIONS

1. Improper surgical masking has constituted a persistent weak link in the chain of aseptic operative technic.

2. The infrequency and seasonal occurrence of nasal and oral borne wound infections do not lessen their severity when they occur and constant "carriers" are met all times of the year.

3. A mask to be effective must fulfill the requirements outlined by Davis.

4. Such a mask, made of impervious, bacteria proof material, with proper breath deflections, is herein offered for use in operating rooms and where proper masking is desired.

REFERENCES

1. Moynihan, Sir Berkeley. Ritual of a surgical operation. *Brit. Jour. Surg.* 8: 27 (July) 1920.
2. Walker, Irving J. How can we determine the efficiency of surgical masks? *Surg. Gynec. and Obst.*, 50: 266, 1930.
3. Meleney, Frank L. *Jour. Am. Med. Assn.*, 88: 1392, 1927.
4. Meleney, F. L. and Stevens, F. A. *Surg. Gynec. and Obst.*, 338 (Sept.) 1926.
5. Kellogg, W. H. and Mac Millan, G. Experimental study of the efficiency of gauze face masks. *Am. Jour. Pub. Health*, 10: 34, 1920.
6. Davis, John S. The Importance of adequate masking during operation. *Ann. Surg.*, 100: 1008 (Nov.) 1934.
7. Maes, Urban. Aseptic Surgical Technic, Lewis Practice of Surgery, Vol. 1, 7, 2.

STRANGULATED INGUINAL HERNIAS IN PREMATURE INFANTS*

SAMUEL L. GOLDBERG, M.S., M.D., AND ALWIN C. RAMBAR, M.D.

CHICAGO

EIGHT hundred and thirty infants who have been graduated from the premature station at Sarah Morris Hospital to the Out-Patient Clinic comprise the material for this study. Thirty-eight infants had 44 inguinal hernias, an incidence of 4.8 per cent. In 6 of these infants, strangulation or incarceration of the hernial sac contents necessitated surgical intervention. Because we feel that the incidence of this complication is greater than has been supposed, and because of our relatively good surgical results, we believe that a detailed report of these cases would be of interest.

Until recently it was felt that strangulation of inguinal hernias in infants was very rare. Herzfeld,[1] in her series of 1500 herniorrhaphies in children, found only 3 instances of strangulation. Fuld[2] reported only one strangulation in 1200 children examined for hernia. Nussbaum[3] saw only 2 instances of this complication in 54,000 children. Frankau,[4] who studied a total of 1487 case records of strangulated hernias, found only 38 cases in infants under two years of age. On the other hand, Krause[5] has operated upon 6 infants to relieve incarceration and believes the incidence as high as 10 per cent. Porter and Carter[6] think the incidence is between 5 and 7 per cent. Deutsch,[7] in a series of 780 hernia repairs, had 29 incarcerations. More recently, isolated case reports have been not uncommon in the literature.

Our own incidence of strangulation of 13.6 per cent[8] is higher than that reported in any similar group. Few if any reports differentiate between full term and premature infants. Whether any such distinction can be made is a question we cannot answer. Our figures show that uncomplicated hernias are not more frequent in infants prematurely born.

Four of the 6 infants were males and 2 females. Their ages varied from forty-eight days to two years, 5 of the 6 being under three months of age. Birth weights varied from 1430 to 2065 grams, the average being 1810 grams. We do not believe that the smaller infants are necessarily more liable to strangulation, although the percentage of uncomplicated hernias was slightly higher in the smallest weight group, under 1000 grams. Likewise the age of gestation seemed to bear no relation to the incidence of strangulation.

Four of the strangulations occurred on the left side, 2 on the right, in spite of the fact that in our entire series of uncomplicated hernias 58 per cent were right sided. This, we think, is purely coincidental.

The existence of an open peritoneal process per se is not the most important cause of strangulation. The coexistence of one or more causes of increased intra-abdominal pressure is more important. Such pressure on the immature abdominal wall musculature will produce herniation through its weakest point. These causes are many, including excessive crying, cough, vomiting, constipation, diarrhea, breath holding, and phimosis. In some cases, more than one cause was present.

Agreement is practically universal regarding the role of the first 4 causes. Phimosis has been disputed; Kelley[9] and Herzfeld[1] believe it important, but Coley[10] and Morse[11] do not. We observed the difficulty with which some of these infants forced a few drops of urine through pinpoint sized preputial openings, and could not help but regard this a significant factor. Accordingly, we circumcised 8 in-

* From the Surgical and Pediatric Services of Sarah Morris Hospital for Children, Michael Reese Hospital, Chicago.

fants immediately upon the appearance of uncomplicated hernia. To date 7 of these remain permanently cured, 5 after immediate disappearance of the herniation, and in 2 the hernias disappeared within a few days. In one infant, with large bilateral, difficulty reducible hernias, the improvement was immediate and marked, so that trusses easily controlled the small, reducible masses. These striking results made us conclude that phimosis is a definite cause of hernia and a predisposing cause of incarceration.

The direct cause of incarceration of a hernia already present is of course not known. In 4 of our 6 infants, it immediately followed the original appearance of the hernia, and in one it followed several days later. This seems to indicate that newly acquired hernias are more liable to incarceration than older existing ones.

CASE REPORTS

Case I. Y. A., female, aged two and one-half months, birth weight 1785 grams, present weight 2895 grams had an irreducible mass in the left groin for twelve hours, with abdominal distention and vomiting. The hernia had protruded several times during the previous three days but had been easily reduced. Operation was done under drop ether anesthesia making the usual herniotomy incision. The sac was found to contain the left tube and ovary and a portion of the uterus. These were freed and replaced and the sac transfixed and ligated. An Andrews' imbrication repair was done using chronic catgut and the skin closed with clips. The baby left the hospital sixteen days later after an uneventful convalescence.

Case II. E. P., male, aged two years, birth weight 1430 grams presented no herniation until fourteen hours before admission when a tender mass was noticed in the left groin. There was distension and obstipation, but no vomiting. Operation was done under ether anesthesia; the sac was isolated and found to contain a dusky loop of ileum which promptly regained its color after it was released. The sac was ligated and an Andrews' imbrication repair was done. Convalescence was without incident and the patient left the hospital after sixteen days.

Case III. S. P., male, aged two months, birth weight 1930 grams, weight at two months 2890 grams. The hernia was noticed first at the age of three weeks but had always reduced very readily. Eighteen hours prior to admission a very tender mass appeared in the right groin. The father partially reduced it about six hours after its appearance. Vomiting began twelve hours before admission. At operation under drop ether anesthesia, a viable loop of ileum which was found in the sac was replaced. After ligating the sac a Bassini repair was done. The sac of a small hydrocele was inverted and a circumcision was done. The convalescence was uneventful. The hospital stay was twelve days.

Case IV. R. B., female, three months old, birth weight 2025 grams, weight at three months 3180 grams. Vomiting began twenty-four hours and a mass in the left groin was first noted eight hours before admission. The child had had no bowel movement for thirty-six hours and was markedly distended. At operation under ether anesthesia, the sac was found to contain a markedly edematous left ovary and tube and the fundus uteri, which were replaced with difficulty. The sac was ligated, Kocherized and a Bassini repair was done using plain catgut. The baby left the hospital on the eleventh day after an uneventful convalescence.

Case V. E. R., male, aged ten weeks, birth weight 1630 grams, weight at ten weeks 2600 grams. Vomiting began sixteen hours before admission and was accompanied by distension and obstipation. A tender mass in the right groin was noted for the first time soon after the onset of symptoms. The infant was in marked shock, the breathing so slow and shallow that ether could not be administered. Infiltration with ½ per cent solution of procaine was used. The sac contained dusky, but viable cecum, terminal ileum, and appendix. These were replaced, the sac ligated and Kocherized and a Bassini repair was done using plain catgut sutures. The postoperative condition was poor but after several hours in an oxygen incubator, it improved. The child left the hospital on the twenty-sixth day, weight 2950 grams.

Case VI. R. T., male, aged forty-five days, weight 2595 grams. For three days the infant vomited every feeding. It had a bowel movement sixteen hours prior to admission. Its

color was only fair, it was markedly dehydrated and in shock. The left sided hernia had appeared for the first time twenty-four hours previously. At operation under ether which was poorly taken, the sac containing the dusky but viable large bowel and considerable fluid, was replaced, the sac ligated, and a Bassini repair was done using chronic catgut. The child's condition was very poor and it died five hours postoperatively, in spite of intensive treatment.

TREATMENT

Conservative treatment of inguinal hernias as a means of preventing strangulation is important. Most hernias in infants will heal if the underlying cause of the increase in intra-abdominal tension is relieved, and if yarn or soft rubber trusses as advocated by Hess[12] are correctly used. Where rapid and complete relief of the increased pressure can be obtained, as by circumcision for phimosis, or surgical relief of an imperforate anus, trusses are often unnecessary. When cough, abnormal crying, constipation, diarrhea, or other predisposing causes occur, they should be promptly tended, and at such times, trusses should be watched carefully to be sure that they are efficient.

Treatment of incarceration or strangulation that has already occurred may be conservative or radical. Some years ago conservative measures were the rule, now the feeling is reversed because perfection of surgical technique has made radical methods safer. "Taxis" is undoubtedly practiced by mothers more frequently than we realize, usually with no trouble, and is probably relatively safe in the early hours. The danger lies in the older strangulations when a non-viable loop of bowel may be reduced, or when bowel or some other viscus may be damaged, or perforated. This damage, unfortunately, does not manifest itself until too late. The strangulated loop has been known to be reduced with the constricting neck of the sac so that externally there is no evidence of herniation, whereas in reality the strangulation has not been relieved.

General anesthesia in itself, without manipulation, may sufficiently relax the ring to permit reduction. This was true in one of our cases. However, once the child is anesthetized, one may do a radical cure so rapidly that we preferred to follow this course.

Radical cure of incarcerated hernia is not difficult except in badly neglected cases. Preoperative preparation is a very important part of the procedure. Much can be accomplished in a relatively short time by active teamwork on the part of the surgeon and his assistants. In the treatment of shock, external heat is important as heat loss of marked degree occurs rapidly in infants and must be combated early, as well as during and after, the operative procedure.

We have found that 5 per cent glucose in a physiologic saline solution is valuable in restoring fluid and chloride balance, and in treating the existing acidosis. Seventy-five to 100 c.c. of this solution is injected into the subcutaneous tissues of the thighs or the small of the back, and is usually absorbed rapidly. We prefer not to use the chest wall or axilla because of possible interference with respiration and with anscultation postoperatively. If necessary, fluids may be introduced into the ankle veins, according to the Spivek method.[13] In some patients a transfusion of 75 to 100 c.c. of blood is a valuable adjunct in treating shock. Whole blood, given intramuscularly, may also help.

Gastric aspiration and lavage through a small catheter is almost imperative to prevent aspiration of stomach contents during anesthesia. The procedure is very simple and consumes practically no time.

Anesthesia may be either general or local. Ether by drop method has been used in most of our cases and by the majority of other authors. We have had no untoward experience with it and probably acts as a mild stimulant when used in the small quantities required. In one infant in this series local infiltration of a few c.c. of ½ per cent procaine was used because the

infant was so moribund and the respirations so shallow, that ether could not be administered.

After ordinary skin preparation, the usual incision parallel to and just above Ponpart's ligament is made through the skin and subcutaneous tissues, and the external oblique aponeurosis is divided along its fibers upward from the external ring for a distance of about 3 cm. At this stage the sac can usually be recognized, and should be isolated well up to the internal ring by very gentle blunt dissection. Rarely, a few adhesions must be cut. Care must be used to prevent injury to the delicate vas and spermatic vessels. The time of opening the sac is not important; in our experience, its opening has been inadvertent more often than not. If necessary, the constricting neck may be divided and the sac contents carefully examined before reduction to determine the viability of the viscus. Heat and moisture will usually produce a rapid return of circulation; fortunately, this occurred in every one of our group. If not, one has two alternatives, resection and anastomosis, or resection and production of a fecal fistula as a life saving measure. It is remarkable how much surgery some of these infants can tolerate. Herzfield reported 2 recoveries following resection of the bowel, as have other authors.

After the return of the viscus, high ligation of the sac and suturing of the ligated stump well under the conjoined tendon (Kocher) constitutes the most important step in the radical cure.

The further repair is not all important. Several authors have used one suture between Poupart's ligament and the conjoined tendon, and one in the external oblique aponeurosis with good results. We believe that a Bassini repair gives a very adequate abdominal wall. Cord transplantation is not necessary and with the possibility of trauma through childhood, it is probably better to have the cord protected by more than one layer of tissue. We have used plain catgut sutures throughout the procedure with no untoward results and do not feel that any more lasting suture material is necessary, though chromic catgut has been frequently used by many surgeons.

As a dressing we have found a strip of gutta percha sealed with collodion to be ideal. It requires little or no care, in contradistinction to gauze, antiseptic powders, and other types of protection advocated.

Postoperative care is very important. Any shock must be strenuously treated. These infants have been returned to the incubators and to excellent nursing care of the premature station. Here we follow the outlined routine which is taken from the standing orders for pyloric stenosis that have been in use at Sarah Morris Hospital for some years.

Routine postoperative care

1. Place infant in *warm* crib and see that it is protected from draughts.
2. Elevate infant's head.
3. Place piece of gauze under chin.
4. Give normal saline solution ounces 1, per rectum, immediately upon return from operating room and repeat every three hours.
5. *First Day.* Three hours after return from operating room give breast milk drams 1 every hour. Increase drams 1 every two hours until ounce 1 is reached at the end of twelve hours. Give water drams ½ every hour, increasing drams ½ every two hours.

 Example:

 9:00 A.M. Returned from operating room. Normal saline ounces 1 per rectum.
 12:00 noon Breast milk drams 1. Normal saline ounces 1 per rectum.
 12:30 P.M. Water drams ½.
 1:00 P.M. Breast milk drams 1. Normal saline ounces 1 per rectum.
 1:30 P.M. Water drams ½.

2:00 P.M. Breast milk drams 2.
2:30 P.M. Water drams ½.
3:00 P.M. Breast milk drams 3. Normal saline ounces 1 per rectum.

and so on until after twenty-four hours feedings of 1 ounce of breast milk are given every hour.

Second Day. Breast milk ounces 1 × 12. Water × 6.

Third Day. Breast milk ounces 1½ × 12. Water in small amounts between feedings.

Fourth Day. Breast milk ounces 2 × 10. Water in small amounts between feedings.

Fifth Day. Breast milk ounces 3 × 8. Water in small amounts between feedings.

Fluid intake is supplemented by subcutaneous physiological saline solution, usually with 5 per cent glucose added. Of course, if vomiting begins and persists, fluids by mouth are stopped, gastric lavage is done and after a few hours free from vomiting the routine is restarted.

Ten to 20 c.c. of whole blood is given intramuscularly, or a transfusion of 75 c.c. of blood is given if there is any indication of persistent shock. Usually, however, within a few hours the infants are in surprisingly good condition.

Any untoward complications are treated similarly to those in adults. The surprising fact in our experience has been the smooth postoperative course of the majority of these infants.

To date, there have been no signs of recurrence of herniation in any of the 5 infants that survived.

CONCLUSIONS

Six instances of strangulation are reported occurring in 44 hernias found in 38 premature infants of a total of 830 infants examined, an incidence of 13.6 per cent. In our experience this complication is more frequent than formerly reported.

Increase in intra-abdominal pressure is an important cause of strangulation. Phimosis is more important among these than is generally believed and should be relieved, if possible, as prophylaxis against complications in all infants with inguinal hernias.

Inasmuch as we had only one death in 6 cases, we conclude that treatment of strangulated hernia should be a radical surgical cure if gentle manipulations fails to reduce the strangulated viscus.

I am indebted to Drs. S. Strauss, B. Portis and N. N. Crohn for permission to include their cases in this report.

REFERENCES

1. Herzfeld, Gertrude. *Edinburgh M. J.*, 32: 281, 1925.
2. Fuld, Joseph E. *New York M. J.*, 109: 233, 1919.
3. Nussbaum, A. *Muncben. med. Wchnschr.*, 60: 1434, 1913.
4. Frankau, Claude. *Brit. J. Surg.*, 19: 176, 1931.
5. Krause, A. *Bruns. Beitr. zur klin. Chir.*, 121: 361, 1921.
6. Porter, L. and Carter, W. E. Management of Sick Infant, St. Louis, 1924, The C. V. Mosby Company.
7. Deutsch, I. *Gyogyaszat*, 431, 1923; *Abst. Internat. Abstr. Surg.*, 38: 327, 1924.
8. Rambar, Alwin C. and Goldberg, Samuel L. *J. of Ped.*, pp. 513–519 (Oct.) 1934.
9. Kelley, S. W. Surgical Diseases of Children, St. Louis, 1929, The C. V. Mosby Company.
10. Coley, Wm. B. Keene's Surgery, Vol. IV, Philadelphia, 1908, W. B. Saunders Company.
11. Morse, John Lovett. Clinical Pediatrics, Philadelphia, 1926, W. B. Saunders Company.
12. Hess, J. H. Premature and Congenitally Diseased Infants, Philadelphia, 1922, Lea and Febiger, p. 430.
13. Spivek, M. L. *Jour. of Ped.*, pp. 199–204, (Aug.) 1935.

BIOPSY IN PROCTOLOGY*

R. V. GORSCH, M.D.

Adjunct Professor of Proctology, New York Polyclinic Medical School and Hospital, Attending Proctologist, New York Cancer Hospital, Associate Attending Proctologist, Midtown Hospital, New York

NEW YORK, N. Y.

ALTHOUGH biopsy may not be necessary to establish the diagnosis in the majority of anorectal neoplasms, it is indispensable in certain doubtful cases. In a large advanced cancer service, we observe that errors in diagnosis are of sufficient frequency to warrant emphasizing the value of early biopsy and the careful sigmoidoscopic examination incidental to it.

It is a deplorable but noteworthy fact, that the early and operable malignant or premalignant tumor of the rectum or sigmoid is seldom observed or palpated by the general practitioner. No doubt, the reason for this lies largely with the patient, but the situation will never be much improved until a satisfactory digital and proctoscopic examination are more generally advised and properly performed; with biopsy when indicated.

Electrosurgical methods offer certain advantages in the technique for biopsy. These we desire to emphasize and to describe a new suction electrode handle which we have found very useful in proctologic technique.

There are several minor details in the examination and in the performance of a biopsy which bear emphasis. Cleansing the bowel by adequate catharsis or enema is desirable, particularly in sigmoidal tumors. A suction apparatus facilitates the procedure and it is our practice to use either 20 per cent peroxide or magnesium sulphate as a cleansing vehicle.

The position of the patient depends largely on the habit of the operator. We prefer the inverted or Hanes position, except in cases where the tumor occupies a sharp sacral curve, in which patients the knee-shoulder position is preferable.

The diathermy apparatus should be properly set and the supplementary equipment connected carefully and arranged accessibly before the patient is placed in the desired position (Fig. 2). Several excellent machines delivering the necessary electrosurgical currents are now available. The operator should be thoroughly familiar with his own machine. We have used the Westinghouse Model F Endotherm with entire satisfaction. The usual control setting for biopsy and electric snare techniques is, cutting strength on and at 6, cutting intensity at R; spark gaps open fairly wide but evenly. The current, of course, is biterminal. The dispersive or indifferent electrode should fit snugly. A footswitch must be in the circuit and operated only by the operator. The settings and controls should be checked at regular intervals. Specially instructed nurses are very desirable. Synnott has described the essential armamentarium for conducting a modern proctologic clinic.

A careful gentle digital examination of the rectum should be done to eliminate adjacent complicating pathology or metastases and to determine by palpation, if possible, a favorable site for the biopsy. Pulsating vessels should be avoided. The majority of tumors present bosselated areas from which a loop of tissue is readily resectable. Those near the centre of the malignant ulceration, when present, are more apt to show the true activity and histology of the growth and are better for grading. It should be appreciated in this regard, that negative laboratory reports

* From the Proctologic Department, Midtown Hospital, New York, N. Y.

are sometimes not conclusive and may even be misleading.

Those tumors which are covered by apparently normal mucous membrane often present a difficult problem and biopsy may be contra-indicated. Such tumefactions may be extensions from neoplasms in adjacent organs, enlarged mesenteric or rectal nodes of inflammatory, tuberculous or granulomatous nature. Benign tumors of the adnexa may be confusing. The question arises whether it is advisable to cut through the mucosa with hazard of subsequent infection or bowel penetration with peritonitis. To biopsy or not must be decided on the merits of the particular case and its value in comparison with the risks involved. Usually the routine laboratory tests will clear the diagnosis. In this regard, the incidence of error in diagnosis between amebic granuloma, lymhopathia venerea and the specific granulomas of tuberculosis and lues with cancer should be noted.

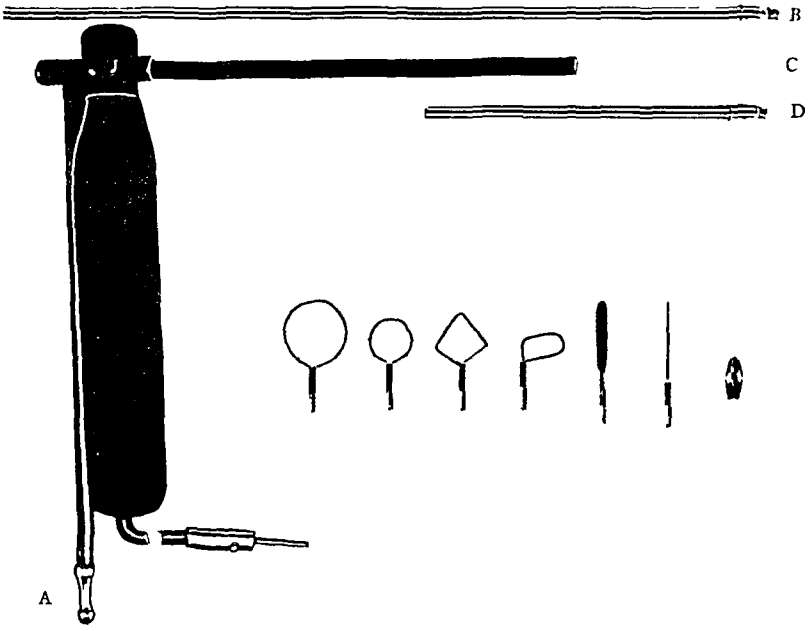


FIG. 1. The author's suction electrode handle. *A*. Suction tube attached to usual tonsil suction apparatus. A variety of electrode tips may be adjusted to any length and any angle, by turning the extension tubes *a* and *b*, in the main shaft *c*.

ANAL BIOPSY

When biopsies are to be taken from anal tumors, it is frequently necessary to anesthetize the spincters. Relaxation of the anal musculature facilitates the digital examination to a degree not yet fully appreciated by the proctologist or general practitioner. A simple perianal injection of 1 per cent novocaine or anucaine which promotes active dilitation and relaxation, will also greatly assist the subsequent instrumental examination.

By gentle eversion of the mucocutaneous junction or skin with Pennington clamps, the tumor is usually readily accessible and exposed. The tissue desired for examination is removed with the cutting loop using a *rapid cutting current, particularly* when only very small pieces of tissue can be secured.

When the anal canal is constricted, it should never be dilated actively. If good exposure can not be secured by gentle retraction, an anoscope of the proper size should be insinuated into the lumen and the biopsy obtained with a small cutting loop as described. Biopsies from anal and perianal tumors usually offer no technical difficulties. It should, however, be emphasized here, that chronic hypertrophies, particularly on the edges of long standing

fissures, openings of chronic fistulas, particularly of the submucous variety, and skin or scar tissue hypertrophies should be more generally biopsied. Surprising reports may follow.

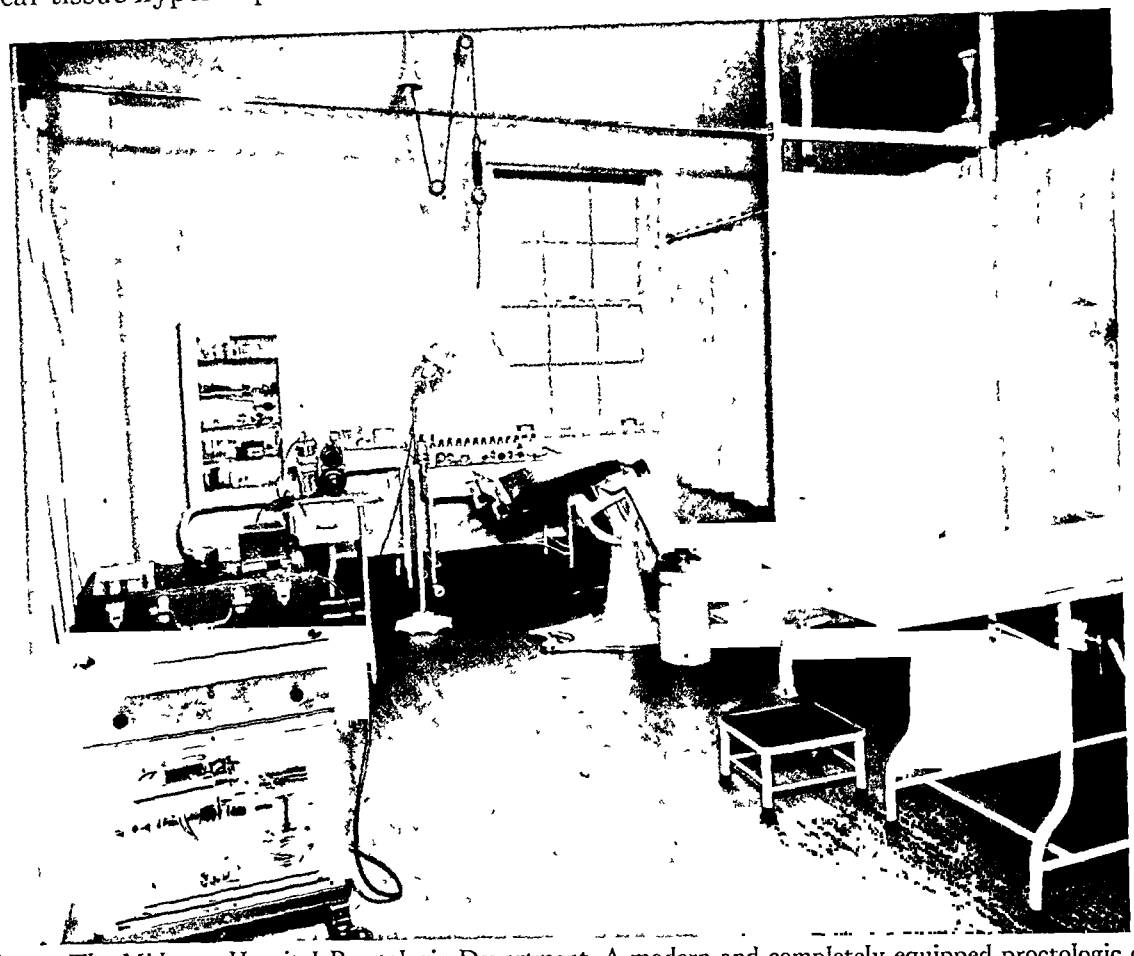


Fig. 2. The Midtown Hospital Proctologic Department. A modern and completely equipped proctologic clinic. Note the suction apparatus, the arrangement of lights, the electrosurgical unit, the Hanes table, the accessibility of all the equipment.

RECTAL BIOPSY

For biopsies from tumors of the rectum proper, the anal canal not being involved, the author prefers a large electric lighted modified Kelly anoscope. Under anal anesthesia as described, it is often possible to see the entire rectum through this scope, which incidentally does not touch or traumatize the tumor. In stout individuals with long anal canals, the longer metal or Bakelite proctoscope may be used to better advantage.

Having cleared the field and selected the site for the biopsy, the author's suction electrode, (Fig. 1) is introduced with the desired sized loop which is slightly engaged into the tumor before turning on the current. This is important since it avoids sparking and sticking of the electrode in the tissues, which should be cut through with gentle lateral and downward pressure. If the proper current setting is used, the loop can be drawn through the tumor like a hot knife through butter.

The suction electrode devised by the author is particularly advantageous in that no smoke blurs the field; the shaft of the active electrode is adjustable to any desired length and the electrode tip may be turned to any desired angle, an important feature in securing biopsies from flat sessile tumors.

In biopsy, the coagulating current, of course, should not be used for cutting since the coagulated area in the base of the

specimen as the loop is drawn through it will destroy the most important part of the tissue and vitiate the proper histological examination. The coagulating current, however, may well be used on the site of the removal to seal any blood vessels and possibly prevent the spread of malignant tissue by implant or traumatic extension. Punched out areas made with the usual cold biopsy forceps may also be advantageously coagulated in this manner.

In those cases where the entire tumor has been removed with the electric snare, it may also be advisable to coagulate the site of removal, bringing it flush with the surrounding mucous membrane, and in selected cases, we frequently circumvallate the site of removal with the coagulating current.

It is at times a very difficult matter to determine the exact depth of the current penetration and it is most important that the operator know his machine and the depth of tissue destruction with the various settings, particularly, when using the electric snare. We have seen bowel penetration with peritonitis following its use in inexperienced hands. Magnifying lenses in our hands have sometimes been of assistance.

It may be noted in passing that biopsy specimens may be readily taken from distal or proximal colostomy loops, by the same technique. The author has suggested the term of abdominal coloscopy for examination of these loops with the sigmoidoscope.

SIGMOIDAL BIOPSY

The removal of biopsy specimens from the sigmoid is done with essentially the same technique as described for the rectum. However, a longer proctoscope or sigmoidoscope is frequently required and the necessity of negotiating a sharp rectosigmoidal angle possibly with adhesions makes the procedure much more difficult than sometimes anticipated. In fact, one finds it necessary to use a small calibre sigmoidoscope through which the convential biopsy forceps will scarcely pass. In these cases, the long suction electrode handle is of particular value, using a small loop.

In very exceptional cases, it may be necessary to secure a biopsy above a stricture which will only permit the passage of a ½ inch scope and through which scarcely any biopsy instrument can be passed. In these cases, we have found the long flexible bronchoscopic biopsy forceps indispensable. This instrument is likewise very useful in securing specimens through the author's extension sigmoidoscope which can be passed 15 inches from the anus.

Under certain conditions, particularly where tumors are definitely above the peritoneal reflections, their removal by the abdominal route with opening of the bowel and followed by resection or anastomosis may prove the less hazardous and the preferable method of approach. It at least envisages the entire pathology and removes all doubt concerning metastases and glandular extensions. Such cases require carefully considered surgical judgment tempered by wide experience.

SUMMARY

A plea for earlier digital and proctoscopic examination of the rectum is made and in doubtful cases biopsy should not be neglected. The author emphasizes the important details and the advantages of electrosurgical methods in securing biopsies from the anus, rectum and sigmoid.

A new combination suction and coagulation electrode handle which the author has found useful in proctologic work is described.

REFERENCES

Synnott, Martin J. The modern proctologic clinic. *Am. Jour. Digestive Diseases and Nutrition*, 11: 3, 1935.

Gorsch, R. V. Oil soluble anesthetics in proctology. *Med. Rec.*, 139: 35–38, 1934.

Guequierre, J. P. and Weidman, F. D. High frequency currents in performing biopsies. *Jour. Am. Med. Assn.*, 103: 22 (Dec.) 1934.

Lockhart-Mummery, J. P. and Dukes, Cuthbert. The precancerous changes in the rectum and colon. *Surg. Gynec. and Obst.* (May) 1928.

TREATMENT OF ACUTE PANCREATIC NECROSIS*

LEWIS F. SMEAD, M.D., F.A.C.S.

Director Surgical Division Staff, Toledo Hospital

TOLEDO, OHIO

ACUTE pancreatic necrosis or acute hemorrhagic pancreatitis is of peculiar interest to the surgical profession because of its spectacular onset, high mortality and strange, uncertain etiology. Many cases have been reported and excellent experimental work has been done, producing a better understanding of the disease. Nevertheless, the mortality is still very high.

The approved method of treatment at present and for the past thirty odd years, is surgical drainage of the pancreas and the biliary system as soon after diagnosis as possible. This has been advocated even in the presence of serious shock. Operated cases make up the bulk of our statistics, and the cases not operated have been those which have been either overlooked or too sick for any surgical treatment. However, the ability of these patients to recover spontaneously is shown by the fact that many cases reach the surgeon only after they have promptly and safely passed through the acute stage of the disease. It is also shown by the discovery of pancreatic abscesses and cysts, which are definitely late sequelae of pancreatitis, and by the reports of the recovery of operated cases, in which the surgical measures employed could have been of little or no use. Most cases of acute pancreatic necrosis will require prompt surgical help, but is the wide exposure, incision and tamponade of the pancreas, with drainage of the biliary system during the early period of profound shock, a wise procedure? Does the chance of recovery depend upon very early operative interference or upon the extent of the primary necrosis and the physical ability of the patient to withstand the shock of the disease? The mild cases may not be injured by the operation but will the severe cases die because of added shock? Will not a delay of several days, or even a week or two during the acute pancreatic phase of the disease, allow the patient to recover from his shock and result in lower mortality? The answer to these questions must come from the study of large numbers of personally observed cases rather than of a large series collected from the literature or hospital records. Nearly all of the writers upon this subject during the last two years still favor immediate operation although fewer of them advocate operation during shock and some are delaying the operation in the milder cases. Others are convinced of the uselessness of early pancreatic drainage but feel that early biliary drainage is of value. However, more surgeons who have had large experience with this operation and who have studied cases at postmortem are realizing the uselessness if not the actual folly of the early operation.

The following men believe in conservative treatment of this disease or differ in some essential respect from the generally accepted view.

Archibald,[1] while advocating early operation, especially with biliary drainage, states it is his conviction that the mortality depends "upon the type and degree of necrosis" and that "it is difficult to see how the dose of poison derived from the killed tissue can be seriously reduced by operation."

* From the Surgical Division of Toledo Hospital, Toledo, Ohio. Read at the forty-eighth annual meeting of the American Association of Obstetricians. Gynecologists and Abdominal Surgeons held at Skytop, Pa., September 16–18, 1935.

DeTakats and Mackenzie[2] advocate expectant treatment if a positive diagnosis can be made and advise against operation in the initial shock of the disease.

Cooke and Whipple,[3] working with acute pancreatic necrosis in dogs say, "There is a very narrow margin between a non-fatal dose which permits recovery, with but little reaction, and the fatal dose which shows profound intoxication and a rapidly fatal outcome. . . . The gland can repair itself in a remarkable manner if left alone in a closed peritoneal cavity."

Eliason and North,[4] after a study of their cases, conclude "the accepted mode of treatment by emergency laparotomy may not be the best one. Our experience favors dealing with these cases as one would with an uncomplicated acute cholecystitis or an acute salpingitis; namely, deferring the operation until after the acute phase, unless an occasion arises demanding immediate surgical interference."

In 1929, Nordmann[5] reports the recovery of 7 of 9 cases treated conservatively and says that these cases "have awakened in him the thought whether it would not be better, in general, to subject to revision the indications for surgical intervention in acute pancreatitis." He also says that in the "early stage only those cases should be subject to operation which, according to all clinical experience, are capable of withstanding the opening of the free abdominal cavity."

Mikkelsen[10] contends that drainage by incision of the pancreas, is anatomically impracticable and may increase the danger of necrosis, of serious hemorrhage or pancreatic fistula. Bile duct drainage he considers more logical but does not feel it has lowered the mortality of the disease chiefly because the patients are too ill for operation. He favors conservative treatment and operates only in cases in which gallstones or gall duct pathology is present and then only from one to three weeks after the subsidence of the acute symptoms of the pancreatic necrosis. In the last eight years he has so treated 39 cases with severe acute disease of the pancreas, 20 of which were extremely ill. His total mortality was 7½ per cent.

At the Mayo Clinic[33] they do not operate upon acute pancreatic necrosis during the stage of shock but if possible prefer to wait until the patient has improved and careful studies can be made of the gall bladder and the gastrointestinal tract.

Parry and Murry,[31] Peterson[27] and Ehrmann[32] are also among those who advocate conservative treatment.

The pancreas lies behind the stomach under the peritoneal floor of the lesser cavity. The greater part of the head of the gland lies between the layers of the mesentery of the transverse colon. The pancreas has no real capsule, either macroscopically or microscopically. The peritoneal covering and a very small amount of fibrous connective tissue continuous with the delicate stroma of the organ, alone separate the anterior surface of the gland from the peritoneal cavity. Therefore, fluid escaping from a necrotic pancreas easily enters the lesser cavity while much of it is distributed in the loose retroperitoneal tissues near the pancreas and in the mesentery of the transverse colon.

Behind the pancreas is a dense network of lymphatic vessels, nerve fibers and the ganglia of the solar plexus. Above it lies the celiac axis, with the large splenic vessels running the whole length of the organ. At the right, around the head of the gland, are the gastroduodenal and pancreatoduodenal vessels. At the lower edge of the neck, the superior mesenteric vessels emerge. Under the pancreas, and in intimate relation with it, are the portal vein, the inferior vena cava, the aorta and the left renal vessels. It is probable that in pancreatitis, the sudden escape of a necrosing fluid among these vital structures is an important cause of the profound shock which follows. Maconie[12] reports the case of a healthy man of twenty-nine years, who was suddenly seized with severe epigastric pain and died in a few minutes. Autopsy revealed a hemorrhage throughout

the whole pancreas as the only cause of death. A number of such cases are reported in the literature. It is evident that it is hazardous to attempt to institute drainage by burrowing among these vessels with an instrument or with the finger, especially when they have been softened by the necrosing effect of escaping pancreatic ferments. Most surgeons do not advocate such a procedure and it is doubtful whether those who do, really open the retroperitoneal tissues sufficiently to establish adequate, immediate drainage which can either remove or prevent the spread of the toxic fluid which is the probable cause of shock and prostration. In fact, it is questionable whether adequate, immediate drainage can be efficiently established. There is no doubt that drainage can be instituted, which will remove the fluids that will be escaping for days and weeks thereafter, and which arise from gradually disintegrating blood clots, dead pancreatic tissue, necrotic fat and from pancreatic secretions escaping from sloughing ducts.

Walzel,[11] after warning against incision of the pancreas, because of his experience with a fatal hemorrhage from the splenic vein, makes the statement: "Genuine pancreatic necrosis is a purely chemicobiologic process which cannot be arrested by a relief incision, as would a bacterial necrotic focus, for instance a carbuncle."

The anatomical possibility of establishing efficient drainage of the pancreas or to the retroperitoneal tissues in the early hours of acute pancreatic necrosis, is one of the principles upon which rests the present method of surgical treatment. From Archibald's[1] animal experiments, we know that necrosis of the pancreas takes place in a very short time, and from clinical experience we know that retroperitoneal infiltration and fat necrosis are well established at the earliest operation. It therefore seems improbable that an operation can be done in time to anatomically limit the process, either in the pancreas or in the retroperitoneal tissue. Moreover, the peritoneum over the pancreas is very thin and offers little or no resistance to escaping fluid. The pancreas itself has no capsule but is made up of many very small lobules each of which is surrounded by a delicate stroma of connective tissue which does not interfere with the escape of secretions. An incision into the pancreas will not drain the whole organ but only the lobules it happens to open. In order to drain the entire pancreas surgically and relieve any possible tension within it, it would be necessary to incise each lobule, a procedure manifestly impossible and certain to add to the local necrosis rather than relieve it. The only efficient retaining wall against escaping fluid is that formed by adhesions and necrotic tissue and this is only effective later in the disease. Furthermore, much of the toxic material remains fixed in coagulated fibrin, fat and necrotic pancreas and cannot escape quickly even if the tissues are opened widely. It, therefore, does not seem logical to make an incision into the pancreas or into the tissues around it to aid in drainage. Finally, as the fluid found free in the peritoneal cavity in the early hours of this disease has been proven to be harmless, it would certainly seem that early drainage of the pancreas or the abdominal cavity is not logical in the light of anatomical or pathological facts. It will be said, however, that clinical cases recover promptly after surgical drainage but it can also be asserted just as positively that they often recover with equal promptness when not operated.

The etiology of pancreatic necrosis forms a strange and incomplete chapter in human pathology. For some cause, a part of the pancreas becomes necrotic, and in the process of degeneration of the dead tissue, certain poisons are elaborated, which when absorbed, are probably responsible for the clinical picture of the disease. Experimentally, death of pancreatic tissue has been produced by the injection of many different fluids into the pancreatic duct. They all have a common ability to cause necrosis, but the most important of these

necrosing fluids is the bile. Clinically, the disease has followed pathology in the gall bladder and liver ducts, obstruction of the pancreatic duct, acute systemic infection, local septic foci about the pancreas, trauma, the interruption of blood supply with infarction in the pancreas and, curiously enough, the presence of a round worm in the pancreatic duct. Whether the necrosis results directly from the immediate destructive action of bile or some other factor, or is due to the autodigestion of the pancreatic tissue by trypsin, is unsettled. Recently, the ability of trypsin to digest living tissue has been questioned.[6] The exact chemical nature of the toxin which causes this disease, and the method of its formation have not been determined. According to Petersen, Jobling and Eggstein,[8] death is usually due to the sudden flooding of the blood stream with the higher split proteins formed at the expense of the necrotic pancreatic tissue. Trypsin has been suggested as the actual poison, or as the cause of the autolysis which produces the toxic split proteins. Histamine has also been mentioned as the possible toxin. Recently, Dragstedt[6] has suggested that the toxic substance is due to bacterial action in the dead glandular tissue. He found bacteria present in the pancreatic tissue of all his experimental animals and, in the majority, it was Bacillus Welchii. Of course, the discovery of a specific toxin producing the symptoms of pancreatic necrosis would be very desirable as it might lead to some means of neutralizing its effect at the critical stage of the disease. Guleke[30] reports the use of heparin as valuable in neutralizing the "trypsin poisoning" which he holds is the cause of intoxication early in this disease.

It has been proven beyond a doubt that bile injected into the pancreatic duct will cause typical pancreatic necrosis, and that obstruction of the lower end of the common duct, as by a stone, stricture, inflammatory swelling or a spasm of the sphincter of Oddi, can form a continuous channel and make the flow of bile from the liver and gall bladder into the pancreas, through the duct of Wirsung, anatomically possible. It has therefore been suggested that decompression of the gall bladder or common duct, at the time of operation for acute pancreatic necrosis, might stop the flow of bile into the pancreas and prevent further necrosis. However convincing this bile theory of pancreatitis may be, it is by no means proved that this disease is usually caused by the reflux of bile into the pancreas, .although the consensus of opinion at present, places it in the leading role. However, Mann and Giordano,[7] after most careful and extensive work, contend that this is only a rare possibility and that we must look elsewhere for the explanation of the cause of most cases of pancreatic necrosis. Nordmann[5] found, that in spite of drainage of both the common duct and the pancreas, a considerable number of cases which showed limited pathology at operation, developed a total pancreatic necrosis by the time they came to autopsy. Granting that the bile factor is of importance in the etiology of pancreatic necrosis, it has not been proved that bile is forced into the pancreas continuously over a considerable time so as to justify drainage of the biliary system as an emergency operation. However, biliary drainage is an important surgical principle in this disease and it should be employed in case there is pathology in the gall bladder or liver ducts in the hope of preventing further attacks of necrosis.

Less convincing, perhaps, is the theory that pancreatic necrosis is initiated by the extension of infection from the diseased liver or gall bladder, by following the lymphatic channels along the cystic and common ducts to the head of the pancreas, or by an ascending infection through the common and pancreatic ducts. Experimentally, the disease has never been so produced. However, the majority of cases of pancreatic necrosis have had a previous history and often a very recent history of

gall-bladder infection, or have shown stones or evidence of cholecystitis or cholangitis at operation or postmortem. From personal experience, also, one is forced to conclude that infection in the liver and its ducts is in some way an important etiological factor, and that the thorough correction of all pathology in the biliary system, as a prevention of future attacks of pancreatic disease, cannot be too strongly emphasized. In this connection Nordmann[5] makes the statement: "At first the concurrence of diseases of the gall bladder and of the pancreas was regarded as coincidental. Gradually, the conclusion has been reached that the two organs are diseased simultaneously much more frequently than had been assumed originally."

The pathology of pancreatic necrosis is well known. Sudden edema of the whole or a part of the organ is quickly followed by hemorrhage and necrosis, and at times, by infection. Pancreatic ferments and toxic substances escape into the blood stream, retroperitoneal tissues and into the peritoneal cavity causing tissue necrosis and a chemical peritonitis. The peritoneal cavity is flooded with a brownish or bloody fluid and the fat of the upper abdomen contains whitish areas of fat necrosis. Later, pancreatic abscesses, cysts, or peritonitis may develop.

The ferments which escape in the early hours of this disease are relatively small in amount and derived only from dead pancreatic tissue and not from the living, secreting gland that is left. This is probably due to the immediate inhibition of gland function by the shock of the pathological process. This is mentioned here because the massiveness of the early pathology and free drainage of pancreatic juice, with skin irritation during convalescence, has created a popular opinion that the free escape of pancreatic secretions plays the important part at the onset of this disease. However, the present belief is, that aside from the neurogenic shock due to the destruction of pancreatic tissue and the surrounding structures, split proteins, the result of autolysis or bacterial action, are the cause of the serious symptoms of the disease, and not the pancreatic ferments. It is of interest in this connection that Senn,[9] years ago, severed the main pancreatic ducts in animals, allowing the pancreatic juice to escape freely into the peritoneal cavity. There was no necrosis nor were there serious or fatal symptoms. This work has been recently verified by Dragstedt,[6] who found that even when such secretions were known to be activated they caused no trouble, if free from bacterial infection. That the cause of the symptoms lies in the dead and not in the living tissue, is shown by the well known experiment of removing a piece of pancreatic tissue under aseptic precaution from one dog and placing it in the peritoneal cavity of another. Death takes place rapidly with the symptoms of pancreatic necrosis. Dragstedt[6] recently claims to have proved that this piece of tissue is harmless, if freed from all bacteria before being placed in the peritoneal cavity. He says that these bacteria are present in the ducts of the pancreatic tissue when removed from the animal and that they are derived from the intestinal canal. If these things are true, it is hard to understand how any operation, short of the actual removal of the dead gland tissue, can stop the formation of the poison, or how drainage, no matter how extensive, can quickly remove more than a small part of the toxic substance.

The characteristic brownish peritoneal fluid, so universally found in the early stage of this condition, is caused by the irritation of toxic substances from the dead pancreatic tissue. These toxic substances are so diluted and neutralized by blood and peritoneal exudate that they are no longer harmful and need not be removed. When the abdomen is opened a week after an acute attack this fluid has usually disappeared.

Fat necrosis is a finding peculiarly diagnostic of pancreatic disease and results from the escape into the tissues and into the peritoneal cavity of the fat splitting

ferment, lipase. The ferment is widely distributed by the lymphatic channels and in the blood stream and does not seem to be toxic. The fat necrosis appears to be more extensive in the severe cases. However, very large areas are not incompatible with the prompt recovery of the patient. The greater part of the mass palpable in this disease is necrotic fat and forms the bulk of the whitish, granular or lumpy postoperative discharge. The large pieces of sloughing tissue discharged after operation and supposed to be pancreas are usually only necrotic fat. It is important for the operating surgeon to decide when to drain areas of fat necrosis. The smaller scattered areas will absorb but the larger ones will break down and form a collection of grey fluid which must be drained. However, in Case XI of this series, operated in December, 1934, such an area about 3 inches in diameter was not drained after removing the gall bladder and a stone from the common duct. The patient has remained well and no abscess or cyst has developed. Besides an increase in size, the indications for draining such a mass are fever, a high white blood count and especially, persistent vomiting with rapid loss of weight. Case VII in this series lost ninety pounds in the three months before it was drained.

The amount of infection present in the pancreas at the onset of acute pancreatic necrosis is relatively so small that signs of suppuration rarely appear in the necrotic pancreas, the extensive areas of fat necrosis, the infiltrated, retroperitoneal tissues, or in the exudate in the peritoneal cavity. When suppuration does develop it is more often late, is localized and can be managed satisfactorily. Early peritonitis with a retroperitoneal cellulitis is a very serious complication and is not easily influenced by surgical measures. The fact that it does occur in a certain percentage of cases is an argument for early operative treatment.

A reason frequently given for immediate operation in acute pancreatic necrosis is that the diagnosis is difficult and that some obstructive or perforating lesion of the gastrointestinal tract may be overlooked. However, such lesions can usually be recognized by means at our disposal, while cholecystitis, the acute lesion most often confused with pancreatitis, can nearly always be treated conservatively. In this connection I would emphasize, that if one will only keep pancreatic necrosis in mind, it will not often be missed.

Acute pancreatic necrosis has been confused with most of the more serious acute surgical conditions of the upper abdomen. The severe pain and shock typical of this disease give the first warning of the nature of the trouble. The onset of the pain is instantaneous and frequently radiates to the shoulder. Marked cyanosis is a sign of severe intoxication. I have seen it only twice and both patients died. Unlike cases with ruptured peptic ulcer, these patients are restless. Persistent, intractable vomiting is a very constant and important symptom. It is watery, with gastric or duodenal contents and is never foul or fecal. The abdominal tenderness and muscle spasm are slight in comparison with the patient's agonizing pain. This is due to the deep, protected position of the pancreas. The tenderness present in the early hours of this disease is definitely over the anatomical location of the pancreas. In cholecystitis the tenderness has its center in the gall-bladder region and is much more acute, owing to the more superficial location of this organ. In ruptured peptic ulcer the generalized tenderness and boardlike muscle spasm develop quickly and are in great contrast to the small amount of rigidity present in acute pancreatic necrosis. Only rarely, too, are acute cholecystitis and ruptured peptic ulcer associated with the severe prostration of this disease. However, many cases of pancreatic necrosis do not exhibit such severe symptoms and are mistaken for other conditions, especially cholecystitis. Under these circumstances, the diagnosis may often be made by the rather acute tenderness of pancreatitis definitely

outlining the position of the pancreas. The generalized tenderness due to the escape of irritating substance from the pancreas is less marked and not so sudden in onset as in ruptured ulcer.

A mass appearing suddenly in the pancreatic region following symptoms typical of pancreatic necrosis, makes the diagnosis practically certain, although it may rarely be confused with ruptured peptic ulcer with abscess. The mass may appear late, may be in the left flank, or, if the patient is fat or distended with gas, may not be palpable at all. The absence of a demonstrable mass is no contraindication to a positive diagnosis, for the area of necrosis may be small, 2 or 3 cm. in diameter, and still cause severe symptoms. The *x*-ray film is of real help in diagnosing tumors of the head and body of the pancreas. In the tumor of pancreatic necrosis, the widening of the duodenal curve and the displacement and distortion of the stomach and colon are very valuable aids. When the tumor is in the left flank, a barium enema and a pyelogram of the left kidney are of help in establishing anatomical relations.

Other less important and less constant findings are mild temporary jaundice, sugar and albumin in the urine, large fatty stools, a high white blood count, over 25,000, and increased residual nitrogen in the blood, and an increase in the hemoglobin and red blood cells from dehydration. DeTakats and Mackenzie[2] say that in the absence of a diffuse peritonitis, a high blood sugar and high diastase content point definitely to pancreatic involvement. Other writers report that the fat splitting ferment, lipase, resulting from tissue necrosis is a valuable diagnostic aid because it is present in the urine longer than diastase. However, the diastase test is the only one that has been used extensively in clinical work. Experimentally it has been found that injuries to the pancreas,[13] ligation of the pancreatic duct[14,15,16,17,18,19,20,21] and of the common bile duct,[16] or artificially produced pancreatic necrosis[24] will result in a great increase of the diastase (amylase) in the blood and urine. As might be expected, in acute pancreatic necrosis and in common duct obstruction by stone in human beings, diastase has also been found greatly increased. However, as it is rapidly eliminated by the kidneys, it is found in increased amounts only during the first thirty-six to forty-eight hours. Although other methods are known,[25,26] the diastase is usually estimated by measuring the ability of this enzyme to effect a given change on a starch solution of a known percentage. The Wohlgemuth test[22] or some modification of it, such as that of Fabricus Moeller,[23] is the most commonly used. The Wohlgemuth test has been found by many workers[16,24,23,27,28,29,30] to be of real clinical value in differentiating acute conditions of the pancreas and gall ducts from other acute abdominal diseases. When there are symptoms fairly typical of pancreatitis and the diastase content of the urine is high, they say that a diagnosis of acute pancreatic disease can be made with certainty. If the ferment is normal in the urine, the trouble is quite surely not in the pancreas or liver ducts. However, it must be remembered that the test is only of value in the first thirty-six to forty-eight hours of the disease, as after this the amount of ferment in the urine quickly falls to normal.

The cases of acute pancreatic necrosis are best classified clinically as fulminating, severe and mild. The variation in the types of cases and the irregular occurrence of such complications as necrotic masses, abscesses and cysts have led to much confusion as to their origin and classification.

The fulminating cases of this disease show all the exaggerated symptoms of sudden agonizing pain, shock, vomiting and cyanosis, typical of the condition. Death usually takes place within a few hours and every form of treatment seems useless. They certainly should not have to suffer the distress of an operation. However, when not operated but treated by general supportive measures a number of

such cases, reported in the literature, have recovered with surprising promptness.

The mild cases of this disease include those of pancreatic edema and those in which only a small amount of the pancreas is destroyed. There is little escape of pancreatic ferments or toxic split proteins and certainly no gross setting free of the pancreatic secretions, for the lesion is often absorbed without operation and, when drained surgically, very little or no pancreatic secretion escapes. In this group the initial pain, shock and vomiting may be severe but the patients recover promptly and within a week may be in excellent condition. Immediate operation upon these cases is harmless but probably cannot stop their progress into the more severe type. Delayed operation is safer and the pathology in the gall bladder and liver ducts can then be thoroughly corrected by cholecystectomy with exploration and drainage of the common duct.

TABLE I

PRIVATE CASES OF AUTHOR	AGE	DEGREE OF PAIN	SHOCK	VOMITING	CYANOSIS	JAUNDICE	GLYCOSURIA	WHITE BLOOD COUNT	FAT NECROSIS	GALL BLADDER SYMPTOMS	GALL BLADDER DISEASE
1 1-23-23 Mrs. G. L.	43	+++	++	+	0	+	+	10,000	+	+++	Cholecystitis, stones.
2 12-26-32 Mrs. E. V. H.	45	+++	++	+++	0	+	+	17,500	+	+++	Subacute cholecystitis, stones.
3. 2-20-23 Mrs. M. T.	31	+	0	+	0	+	0	12,000	0	++	Acute infection
4. 11-10-17 Mrs. H. P.	23	+++	++	+++	0	0	0	18,000	++++	++++	Cholecystitis, stones.
5. 7-23-24 Mrs. E. S.	57	+++	+++	++++	0	0	+	13,000	++++	++++	Cholecystitis, stones.
6. 1-30-33 Mr. F. S.	50	+++	++	+++	0	+	0	15,000	++++	++++	Empyema, stones, rupture, abscess.
7. 10-12-28 Mrs. H S.	23	+	0	++++	0	0	0	14,000	0	+++	Cholecystitis, stones.
8. 10-10-28 Mrs. M. C.	35	+++	++	++	0	0	0	15,800	+++	+++	Cholecystitis, stones.
9. 4-29-27 Mr. S. O. R.	65	++++	++++	+++	++	0	0	16,000	++	+	Cholecystitis.
10. 10-25-21 Mrs. M. S.	40	++++	++++	++	++	0	0	33,000	++	0	Not explored
11. 12-13-34 Mr. P. K.	54	++++	++	+++	0	0	0	18,500	++	+++	Cholecystitis, stones in gall bladder and common duct
12. 1-11-35 Mrs. M. W.	36	+++	+++	+++	0	0	+ Diabetes	20,200	+++	0	Slight cholecystitis.

The intermediate group of severe cases is the largest. The clinical symptoms are very alarming and the mortality high, but these patients have a tendency to react and the majority of them recover. Other things being equal, the question of life or death is probably determined very early

in the disease by the amount of the pancreas involved and by the physical ability of the patient to withstand shock. Many in this group will require surgical drainage of the necrotic pancreas and most of them correction of the pathology in the biliary system. They die of shock, infection or from inanition from persistent vomiting, or go on to abscess or cyst formation. For years this group has been treated by immediate operation in the earliest possible stage of the disease. It is here contended that this method does not limit the extent of the disease nor does it, by drainage, relieve the early, primary shock sufficiently to justify the risk of the operation. It is believed that morphine, ample fluids with saline and glucose and other supportive measures will give a better chance of recovery from the immediate precarious condition.

TABLE I

PANCREATIC PATHOLOGY	COMPLICATIONS	PANCREATIC DRAINAGE	BROWN PERITONEAL FLUID	RESULT	TIME OPERATION	OPERATION	MAXIMUM TEMP.
Moderate necrosis.	Continued attacks of pain postoperatively.	None.	None.	Well 14 years	Deferred 2 weeks	Cholecystectomy, exploration and drainage common duct.	98.6
Moderate necrosis.	None	None	None	Well 2 years	Deferred 6 days	Cholecystectomy, exploration and drainage common duct.	100
Edema, mass.	Temperature 99.5°, acute tonsilitis.	None	None	Well 12 years	Deferred 10 days	Cholecystostomy, drainage pancreas.	99.5
Extensive necrosis, mass.	High fever, infection, hemorrhage	Large amount	Large amount	Well 17 years	Third day	Cholecystostomy, drainage pancreas.	104
Extensive necrosis, mass.	Severe asthenia, infection.	Large amount	None	Died 5 months	Deferred 14 days	Cholecystostomy, drainage pancreas	101
Extensive necrosis, mass.	Acute cholecystitis, rupture & gall bladder.	Very large amount	None	Well 1 year	Deferred 4 weeks	Drainage necrotic pancreatic mass, cholecystostomy.	102
Cyst.	Asthenia, loss of ninety pounds.	Large amount	None	Well 4 years	Deferred 3 months	Drainage pancreatic cyst three months after cholecystectomy.	100
Necrosis, abscess.	Acute cholecystitis.	Large amount	None	Well 4 years	Deferred 14 days	Lumbar drainage pancreatic abscess, cholecystectomy.	104
Moderate necrosis.	Extremely fat.	None	Large amount	Died second day disease	Second day	Drainage pancreas, in shock.	97
Not explored		None	Large amount	Died third day disease	Third day	Drainage abdomen, in shock.	97.4
Extensive necrosis.	Stones in gall bladder and common duct	None	Only turbid fluid	Well nine months	Ninth day	Cholecystectomy and removal stones from common duct and drainage	100.6
Extensive necrosis and hemorrhage	Diabetes, pituitary, discharge	None	Very little	Died third day disease	No operation	None. (Autopsy)	105.5

Granting that the diagnosis of pancreatic necrosis is correct, it must be decided for each individual patient at just what stage of recovery surgical procedures are best instituted. If the patient survives the period of shock, it is surprising how promptly he may recover and how well the walled off necrotic mass is tolerated. If, after several days, the symptoms tend

to increase as the result of the infection, drainage should be established in the simplest possible manner. Even then, operation should be undertaken only when the patient can reasonably withstand the procedure.

When this period of shock has passed the operation may be performed immediately if good surgical judgment so indicates in any individual case. However, within one to three weeks after the onset of acute pancreatic necrosis the cases which have survived and have not required drainage for infection will usually have recovered sufficiently for careful study and necessary surgery. Cases with no pathology in the biliary system, stomach or duodenum, and no large areas of necrosis about the pancreas cannot be helped by abdominal surgery. However, biliary disease or a history of it is so very common in these conditions that only rarely will there be a case which will not need exploration of the gall bladder and liver ducts. When a large mass, with extensive fat necrosis, has formed near the pancreas it will require an operation. However, at the time that this is done a thorough correction of all biliary disease is impossible and even a simple drainage of the gall bladder may be very difficult because of extensive adhesions and fat necrosis. If the area to be drained is small, the biliary pathology may be corrected at the same operation. In many cases, however, no areas of necrosis will need draining and only the biliary pathology will remain to be corrected. This is best accomplished by removing the gall bladder and carefully exploring the common duct for stones or other obstruction. It is my opinion that correction of all pathology in the biliary system is necessary for the prevention of further trouble in the pancreas and that the removal of the gall bladder is needed to accomplish this. In addition all other foci of infection, so far as is possible, should be eliminated, for they may be a real etiological factor.

If the operator feels that he must follow surgical teaching and operate during the early acute stage of this disease or, if he has come upon the condition with a mistaken diagnosis, he should certainly limit his efforts to the simplest adequate drainage of the biliary system and of the lesser peritoneal cavity. Thorough correction of all biliary pathology at this stage is too dangerous and even drainage of the pancreas may prove unsatisfactory so far as later sloughing is concerned.

The clinical experience which forms the basis for this paper was derived from the study of 12 private cases of acute pancreatic necrosis, all proved by operation or autopsy and carefully observed during the whole course of the disease. Among these cases there were four men and eight women, their ages ranging from twenty-three to sixty-five years. The pain was severe in 10, moderate in 2. In 3 cases the shock was ultra severe; in 6 severe; and mild in 3. Vomiting was present in all the cases; cyanosis in 2; jaundice in 4; glycosuria in 4; and fat necrosis in 10. The leucocyte count ranged from 10,000 to 33,000 and the temperature from 97° to 105°F. Gall-bladder symptoms or gall-bladder disease were found in 11 and the information was not obtainable in one. The pathological processes present in the pancreas were edema, hemorrhage, necrosis, cyst and abscess. The complications were hemorrhage, sepsis, asthenia and ruptured gall bladder. Postoperative pancreatic drainage was free in 5 and absent in 7 cases. Brownish peritoneal exudate was present in 4 cases; it was never found at operations deferred for two weeks, and in one case it had disappeared at operation done on the sixth day of the disease. Four cases died and 8 recovered. Two of the 4 who died were operated on the second and third days while in shock. The third case was operated on the fourteenth day and died of asthenia at the end of five months. The fourth, a fulminating case, was not operated at all. The other cases, except one, were deferred from six days to four weeks. All the various surgical procedures, except incision of the pancreas

itself, were used for different stages and conditions of the disease.

CONCLUSIONS

Early operation in acute pancreatic necrosis, during the period of shock, is not justifiable because we have no efficient surgical means of relieving the shock or of removing its cause, and, also, for the reason that the operation adds seriously to the risk already present. All known operative measures such as cholecystostomy, cholecystectomy, drainage of the common duct and of the lesser peritoneal cavity and incision and drainage of the pancreas, have probably not limited the extent of the necrosis or appreciably lowered the mortality in the early stage of the disease. The removal of the fluid from the lesser peritoneal cavity and from the retroperitoneal spaces in the early hours of the disease is accomplished very imperfectly and is not as valuable as usually assumed. In acute pancreatic necrosis, the frequent occurrence of pathology in the gall bladder and liver ducts is no mere coincidence but its correction is of prophylactic, not of curative value. The fatal cases have all shown extensive necrosis of the pancreas and this uncontrollable factor when measured against the physical resistance of the patient is believed to be the deciding cause of death. It is noticeable, however, that many reported cases die very soon after an early operation. The margin of safety between the fatal and non-fatal cases is very narrow at times and it is believed that at the critical period the patient can handle the situation more safely if not embarrassed by the shock of an operation. Most cases of this disease will require surgical help at some stage, but the opportune time can be decided only by experienced surgical judgment. Is it not probable that the real problem of lowering the terrible mortality of acute pancreatic necrosis is more likely to be solved by the biological chemist than by the surgeon?

REFERENCES

1. Archibald, Edward W. and Kaufman, Mark. Surgical Diseases of the Pancreas. Practice of Surgery. Dean Lewis, 7: Chapter 1, pp. 1–65.
2. de Takats, Geza and Mackenzie, Wallace D. Acute pancreatic necrosis and its sequelae. *Ann. Surg.*, 106: 418–439 (Sept.) 1932.
3. Cooke, J. V. and Whipple, G. H. The metabolism of dogs with sterile abscess, pancreatitis, and pleuritis. *Jour. Exper. Med.*, 28: 223–241, 1918.
4. Eliason, Eldridge L. and North, John P. Acute pancreatitis. *Surg., Gynec., and Obst.*, 51: 183–189, 1930.
5. Nordmann, O. Akute Pankreasnekrose und Cholecystitis. *Chirurg*, 1: 721–726, 1929.
6. Dragstedt, L. R., Haymond, H. E. and Ellis, James C. Pathogenesis of acute pancreatitis. *Arch. Surg.*, 28: 2, 223–291 (Feb.) 1934.
7. Mann, Frank C. and Giordano, Alfred S. The bile factor in pancreatitis. *Arch. Surg.*, 6: 1–30, 1923.
8. Petersen, W., Jobling, J. W. and Eggstein, A. A. Serum changes and cause of death in experimental pancreatitis. *Jour. Exper. Med.*, 23: 491–498, 1916.
9. Senn, N. The surgery of the pancreas. *Am. Jour. Med. Sc.*, 92: 162–165, 1886.
10. Mikkelsen, O. Acute pancreatitis. *Acta chir. Scandin.*, 75: 373 (Sept. 26) 1934.
11. Walzel, Peter. Contributions to the surgery of the pancreas. *Arch. f. klin. Chir.*, 148: 67 (Oct.) 1927.
12. Maconie, A. C. Sudden death due to acute hemorrhagic pancreatitis. *Brit. Med. Jour.*, 2: 638 (Oct. 9) 1926.
13. Wohlgemuth, J., and Noguchi, Y. Experimentelle Beitraege zur Diagnostik der subcutanen Pankreasverletzungen. *Berl. klin. Wchnschr.*, 49: 1069–1072, 1912.
14. Schlesinger, W. Uber den Ursprung des diastatischen Fermentes im Blute und ueber seine Beziehungen zum Diabetes mellitus. *Deutsch. med. Wchnschr.*, 34: 593–595, 1908.
15. Clerc, A., and Loeper, M. Influence de la ligature du canal pancriatique sur le pouvoir amylolytique du sang. *Compt. rend. Soc. de biol.*, 66: 871–873, 1909.
16. Wohlgemuth, J. Beitrag zur funktionellen Diagnostik des Pancreas. *Berl. klin. Wchnschr.*, 47: 92–95, 1910.
17. Gould, L. K., and Carlson, A. J. Further studies on the relation of the pancreas to the serum and lymph diastases. *Am. Jour. Physiol.*, 29: 165–181, 1911–12.
18. King, C. E. Studies on blood and urinary amylase. *Am. Jour. Physiol.*, 35: 301–332, 1914.
19. Elman, R., and McCaughan, J. M. The quantitative determination of blood amylase with the viscosimeter. *Arch. Int. Med.*, 40: 58–64, 1927.
20. DeTakats, G. and Nathanson, I. T. Correlation of internal and external pancreatic secretion. III. The effect of ligation of the tail of the pancreas on diastase in the blood. *Arch. Surg.*, 19: 788–793, 1929.

[*For Remainder of References see p. 510.*]

CASE REPORTS

IMPORTANCE OF PRICKLE CELL LAYER IN SKIN GRAFTING

EDWIN J. GRACE, M.D., F.A.C.S.

Grace Clinic

BROOKLYN, N. Y.

IN 1925 Thuringer, in studying the histology of the skin, noted that the greatest number of mitotic figures were seen in the lowest part of the prickle cell layer. He studied various parts of the body but the mitotic activity of these cells was always constant. Hartwell, independently, while studying the healing of surgical wounds noticed contrary to the accepted teaching that the cells of the prickle cell layer were definitely the most active in wound healing. The role of the basal cell layer was unquestionably secondary.

Appreciating the value of this observation I am reporting a case of pinch graft to the neck in which a definite effort was made not to go beyond the lowest part of the epidermis, feeling that grafts with a base of active mitotic cells should give a higher number of satisfactory takes. In the case to be reported forty-three of forty-eight skin grafts applied to granulatory wound of the neck took successfully.

CASE REPORT

P. S., aged fifty-two years, was admitted to St. Mary's Hospital with a large sloughing carbuncle of the neck, 15 × 8 cm. After trying conservative treatments unsuccessfully the case was operated and the entire carbuncle removed en masse. After six weeks this granulating wound was skin grafted using the mentioned observation in our operative technique.

All laboratory findings were negative except for a grade 1 (I–IV) sugar in the urine, which was easily controlled with a dietary regime. The hemoglobin was 58 per cent, Dare or 8 grams per 100 c.c. of whole blood.

The pinch grafts, under local anesthetic, were removed from the right side of the back under the scapula, at no time going beneath the epidermis. A plain straight needle clasped in a Kocher clamp was gently pushed in the epidermis and the skin elevated, while in this position a sharp razor cut off the elevated tissue. The grafts each averaging in size about 2 to 4 mm. in diameter, were applied to the patient's neck and covered with paraffin mesh gauze held on with strips of adhesive.

In reporting this case I feel that the large number of satisfactory takes might be attributed to confining the section of epidermis taken for the graft to that portion which histologically is the most active in skin regeneration.

SUCCESSFUL OPERATION FOR MESENTERIC VASCULAR OCCLUSION

W. S. BROWN, M.D.

Surgeon, Sherman Hospital

ELGIN, ILL.

IT IS nearly a century since Tiedemann in 1843, first recognized this condition. For several years it was merely a finding at necropsy, but has since assumed a position of great importance in clinical surgery. The term chosen, suggested by Trotter, seems preferable to "mesenteric embolism," "mesenteric thrombosis," "mesenteric arterial embolism," or "mesenteric venous thrombosis."

INCIDENCE

The condition while infrequent, can scarcely be termed very rare: In thirty-three years there were 206,571 surgical admissions to Boston City Hospital, Robey states, and 51 instances of mesenteric vascular occlusion. Sheahan reports 13 among nearly 50,000 surgical cases in 11 years at the Massachusetts General Hospital. Of the 30,000 surgical admissions in a decade at the Lankenau Hospital in Philadelphia, there were but 2 cases, both in veins, according to Ross. At the Baylor Hospital in Dallas, Flynn writes 2 examples were met in 27,712 surgical affections. Warren and Eberhard state 11 of the 26,793 surgical admissions at the Palmer Memorial Hospital, Boston, were for this affection. At the Tübingen surgical clinic only 3 cases occurred Reich reports in ten years; and in the same country Saxer informs us but 6 examples were discovered, one venous rest arterial, in the extensive necropsy service in Leipzig; while there were 9 cases in Ophüls', of Leland Stanford University, series of 3000 necropsies.

Coming now to private practice, Blackburn some years ago sent a questionnaire to 115 surgeons in the territory of the Southern Medical Association, receiving reports of 45 unpublished cases, verified by operation or necropsy. These occurred in 40,000 to 50,000 abdominal cases, about 1:1000.

Recently, since interventions for "acute abdomen" have grown so numerous, this affection is recognized more often. After Watson became interested in the condition at the Boston City Hospital, he found 8 cases in a year, while only 6 had been previously noted in nine years. So too, Loobe operated on 9 instances in three years, and MacCornack 3 cases in eight years. Further evidence as to the uneven occurrence of the condition is found in Councilman's statement that his 3 necropsies were all done in a fortnight, the "first specimens seen for a number of years."

This mesenteric occlusion is found in horses as well, in this animal being due to aneurysms caused by a parasitic worm, Strongylocentrus armatus.

Sex: The proportion given long ago by Jackson, Porter and Quinby was 64 per cent for men, and 36 per cent for women; but of 210 recent cases the difference was not quite so great, 131 men and 79 women.

Age: We find the extremes of life involved, of the 210 cases collected by Jackson, Porter and Quinby, 2 were "90 or over." On the other hand, this lesion has been found in infants of four weeks (McClanahan), 5 weeks (Cokkinis) and 6 weeks (Ingebrigtssen). Three boys, one of 8 and two of ten years seen by Frank were successfully operated on.

It has been learned of late years that the average age is lower than supposed formerly. Thus of 308 subjects, 63 per cent were under fifty years; and in the 76 personal cases cited by Cokkinis, no less

than 76.3 per cent were under fifty years, some 13.3 per cent under twenty years.

Friedman gives the details of cases in two brothers of forty-four and forty-six years, respectively; and curiously, the inferior artery was involved in both.

Race: There are few details of this aspect, though of 61 recent cases in this country, only 8 were in negroes and one in a Chinaman.

ETIOLOGY

In the series of 360 cases collected by Trotter, 53 per cent involved the arteries, 41 per cent the veins and in 6 per cent there was simultaneous obstruction of both arteries and veins.

Occlusion of the superior mesenteric artery is more common than of the inferior, as might be expected from its larger caliber, 8 mm. compared to 3.5–5 mm. for the inferior, according to Henle and Poirier; its origin above the other, and its more direct course, running parallel with the aorta, while the inferior is given off at an angle of about 45°. The cause here in most instances is endocarditis or arteriosclerosis, of 79 cases, 57 were due to endocarditis, 17 to arteriosclerosis, and in the rest no etiologic factor was discovered (Brady, Reich, Robey). In Gordon's patient syphilitic endarteritis was present; and in the two brothers seen by Friedman there was "premature" arteriosclerosis.

Lagane recognizes an "arteriosclerotic syndrome of the intestine" Of which there are two factors, atheroma of the mesenteric arteries and arteriosclerosis of the intestinal arteries. The former are generally associated with chronic lesions of the aorta and the rest of the vascular system, often in syphilitics past fifty years and atheromatous. Arteriosclerosis, on the other hand, occurs in young subjects, alcoholics, with plumbism, former enterics, or history of acute or chronic intestinal disease. Details of 2 necropsies on cases in this category were given by Councilman: (1) A woman of eighty-five years with the entire abdominal aorta atheromatous, many thrombi on the calcareous plates, the largest just above the opening of the superior mesenteric and almost completely blocking the orifice of the artery. While the thrombus extended a short way into the vessel, the latter contained neither thrombi nor emboli. (2) A somewhat similar case of a man of sixty-one years, except the occlusion was midway between its origin and the bowel.

Venous occlusion is generally caused by a thrombus extending down; it may, however, be primary from some infection originating in the intestinal tract, notably appendicitis. Ochsner alludes to 5 examples in young individuals from alcoholic excesses. In the man of fifty-three years of age, seen by Rixford, venous occlusion was established by pancreatitis with fat necrosis.

The onset is often postoperative, following herniotomy, thyroidectomy (Maylard), gastroenterostomy, myomectomy, hemorrhoidectomy. In Douglas' case, a man of thirty-seven years, there had been appendectomy three months prior. In another man, aged twenty-six years, at Küttner's clinic in Breslau, referred to by Melchior, appendectomy on March 26; on April 6 and 8, chills, on 10 twice. Successful operation next day showed edematous mesentery. Smith's patient, a woman of twenty-eight years of age died after appendectomy. Fatal thrombosis of the mesenteric veins occurred after splenectomy in a woman of thirty-six years operated on August 22 and died on September 15. Several other cases are reported by Mauclaire and Jacoulet and Douglas following splenectomy. Finucci saw a patient of forty-three years of age about three days after a subtotal hysterectomy; a side-to-side anastomosis was unsuccessful. Smith, in a similar case, removed 15 inches of ileum, and made anastomosis successfully by the end-to-end plan. Of the 51 cases to which Robey alluded 24 were of surgical origin, 13 postoperative, with only 2 clean cases, and again, 6 were instances of acute appendicitis or peritonitis. In one of

Hedlund's patients, aged thirty-six years, after an operation for a tubal abortion, the pain persisted constantly. Another operation for the mesenteric occlusion failed. Many other instances of this postoperative type could be cited, but these will serve as samples. Curiously enough, Mauclaire and Jacoulet state, operations on the mesentery itself are not often responsible.

Trauma is apparently an occasional cause: Thus in the youth of seventeen years seen by Eisenberg and Schlink, fatal occlusion followed a fall striking the abdomen on a cement floor. A man of thirty-seven years, in railway station struck his abdomen against a car step, a month later there was a sudden onset of pain and vomiting. A side-to-side anastomosis failed. In Kojeff's case, necropsy showed an old clot in superior mesenteric vein obliterating it and microscopic examination disclosed an old rupture of the venous wall. In Klein's case a man of sixty-one years, forty-two days after a fracture of the femur, there was an acute obstruction for forty-four hours, with bloody vomitus, then profuse and watery diarrhea with blood, who recovered without operation but it was presumed to be this variety of occlusion. Addison operated on a woman aged forty-two years, with a history of unusual muscular exertion upon lifting 3 days prior followed by a large swelling in lower half of abdomen, containing blood-stained fluid at operation fifteen hours after the onset, there was a sharp line of demarcation and about 12 inches of bowel was successfully resected. Postoperatively there were some slight cardiac changes. Munro's patient, a man of fifty-one years, also gave a history of heavy lifting, as likewise in Cave's case of another man, aged forty-two years. Cawadias and Catsaras give the details of a case in a man aged thirty-three years, with a strangulated hernia with involvement of 24 inches of bowel. He died in a few hours. For six years there had been intermittent claudication. At necropsy sclerosis of the aorta, coronary, iliac, femoral and mesenteric arteries were found. The primary intermittent claudication came from stenosis of the iliac or femoral artery; five years later he had angina due to the aortic lesion and he died from intestinal infarction, the terminal syndrome of mesenteric arteritis. An intermittent claudication was noted in a man, aged thirty-two years, seen recently by Taube.

Bedridden patients may be attacked; for example, a woman aged seventy-nine years, seen by Selby, developed this condition after twelve days' rest in bed for fibrillation. Another of Hedlund's patient, of the same sex and age, was affected during pneumonia. At necropsy a liter of pus was present in the abdomen and six inches of the ileum was gangrenous.

Lastly, in a considerable number, principally venous occlusions, no sufficient cause can be found to produce the condition. The experimental work is inconclusive for humans, the duodenum or terminal ileum being involved rarely.

PATHOLOGY

The arteries were occluded in 371 cases, and the veins in 258 (Brady, Cokkinis, Jackson, Larson, Reich). Of 267 instances, the superior mesenteric artery was involved 237 times, the inferior 6 times, and both 24 times (Blackburn, Reich, Trotter).

With this preponderance of the superior mesenteric vessel, it is evident the lower part of the jejunum and the ileum will be most affected. The extent involved may vary from only a few centimeters to the whole of the small intestine, and the cecum, ascending colon, and even part of the transverse colon, as in Cave's case.

Whether this occlusion of the superior mesenteric artery is sudden or gradual, we may have: (1) obstruction of the intestine without infarction, the vascular supply while not enough to maintain physiologic function is adequate to nourish the intestinal tunics. (2) Infarction of the intestine, usually hemorrhagic in type, the anemic being exceptional. In one of Councilman's cases, a man of sixty-one

years, the hemorrhagic infarct involved almost the entire small intestine by occlusion of the artery from its beginning. Here the damage ranges from minor lesions in the mucous lining to gangrene of the whole wall. (3) A collateral circulation may ensue which may continue through the life of the individual, as in the cases of Chiene, Trotter and Ophüls to be narrated shortly. Or, the cardiac or arterial disease may increase and overcome this collateral circulation.

Of 157 individuals, the jejunum was affected in 34, the ileum in 47, most of the small bowel in 35, and the small as well as the large in 41 (Cokkinis, Reich). Curry and Backus successfully operated on a man, aged sixty years, in whom there was 12 inches of gangrenous midjejunum, which seems to be an infrequent site. Cokkinis states that in only 17 of his 42 cases did the extent of the affected bowel exceed 8 feet and in 2 of these 17, it was under 10 feet. However, in a woman of forty-eight years, nearly all of the small intestine, cecum and much of the ascending colon were gangrenous (Cave). Actual gangrene was found in 29 of Cokkinis' 42 cases.

Wulsten not only made a correct preoperative diagnosis but operated successfully in a man of sixty-four years, in whom the superior mesenteric artery was blocked completely by clots to its remotest branch. Occasionally, as in Schley's successful operation in a man of forty-two years, the arteries bleed during operation but the veins are thrombosed; so too, in Douglas' case.

In Chiene's case, in a woman aged sixty-five years, and a dissecting room subject, there was an ancient embolism of the celiac axis and mesenteric arteries. An aneurysmal sac was present from which the inferior mesenteric sprung. While both arteries were obliterated at their origin, the branches were filled with the injection mass, proving collateral circulation had been established. Long after this finding, Trotter saw a man of forty-six years, also with an aneurysm, though there was a complete closure of the superior and partial of the inferior artery, yet no symptoms ensued owing to complete collateral circulation. Symptoms of aneurysm had been noted for twenty-seven years. In the man, aged thirty-five years to whom Rixford referred, a dissecting aneurysm of the aorta established a mesenteric occlusion by pressure of the blood between the adventitia and the media. In an exceptional case, the superior mesenteric artery was closed by an old adherent embolus, and in spite of this the small bowel was found normal, Ophüls cites.

The occluded segment may be sharply defined, as in my case, but often gradually shades off, as in Lothrop's case. The contents are "generally dark, offensive, semifluid material which is either streaked with blood, or consists of almost pure blood . . . partly clotted, tarry, or dark red and liquid. . . . may be present in the lumen when none passed per rectum or vomited . . . generally an accompaniment of gas" Trotter).

Free fluid in the peritoneum is of three types: (1) pure ascitic fluid, always from cirrhosis of the liver or endocarditis; (2) seropus or purulent after peritonitis develops; (3) blood stained fluid or actual blood, of a few ounces to three or four pints, is the only variety caused by the occlusion itself. These three may coexist (Cokkinis).

As just stated occlusion of the inferior mesenteric artery is uncommon. Brown and Dey record an example in a woman aged forty-five years, who was admitted for a gastroenteritis; at operation the lesion was sharply demarcated and no pulsation was detected in the artery. In Ferguson's case, a man of sixty-four years, a patch of atheroma surrounded the orifice of the inferior mesenteric and a fragment occluded the lumen. Both ended fatally despite intervention.

Of 137 instances of venous thrombosis, there was infarction in 91 and in 60 of these again, from thrombosis or other morbid condition in the portal vein

(Trotter). Primary venous thrombosis is rare, 4 of the 57 personal cases, all occurred in superior mesenteric vein. In 40 cases of secondary venous thrombosis, 27 were in the superior vein and 13 were doubtful. Primary thrombosis of the mesenteric arteries, apart from embolism is uncommon, 2 only occurring in 79 instances (Cokkinis).

SYMPTOMS

Since the extent of the bowel in which the circulation is blocked varies from a few inches to many feet, it is evident that no clear cut clinical picture will be present. As a rule, the condition cannot be differentiated from acute ileus, such as is due to intussusception, volvulus and other causes. Nevertheless, there are two types, acute and chronic, the former with sudden, fulminating onset, sharp, agonizing pain, nausea and vomiting and bloody diarrhea, generally follows arterial obstruction alone or combined with venous. On the other hand, in the chronic type, generally in venous obstruction, the onset is frequently insidious; there may even be no manifestations referable to the abdomen.

Pain is the most characteristic symptom present in the great majority of cases. It is severe and agonizing, at first colicky and intermittent, later becoming constant. The severity seems decidedly disproportionate to the clinical findings. It is not relieved by morphia, enemata or the usual measures; in Brown and Dey's case morphia had no effect, in one of Frank's cases, a boy of eight years, no result was had from enemata, and in Selby's patient, drugs had no effect for six hours. The pain is generally situated about the umbilicus or epigastrium but may become generalized. Moreover, it may shift its location from the umbilical or epigastric regions to the right lower quadrant, then, of course simulating appendicitis; in short, the painful phenomena of "acute abdomen" suggesting exploratory laparotomy.

Temperature may be normal or even subnormal at the start, but in nearly every instance rises steadily.

Pulse grows progressively more rapid, and quickly assumes that typical of acute hemorrhage, small, hard, rapid, 100 to 140 or 150, and often irregular.

Distention is one of the most constant signs, usually makes its appearance early, increases gradually, and may affect only the upper or lower half of the abdomen.

Palpable mass, though present in my case, is often difficult to elicit because of the distention, tenderness and rigidity. Visible peristalsis is excessively infrequent, Trotter found it noted in but 4 of 360 cases.

Vomiting is another early and constant symptom, it may lessen in a few hours or persist. At first alimentary, it then may contain blood, in 16 per cent, according to Reich. While in my case the vomiting was fecal in character, this is uncommon, occurring in 2 of 76 cases reported by Cokkinis. Though hematemesis is of great significance, it is less common than melena.

Constipation and Diarrhea. Neither of these is typical, one may occur singly, sometimes both or neither may be present. Sometimes, again, both may be present at different times. Reich states diarrhea is found in 41 per cent of the cases and in 26 per cent the stools contain blood.

Absence of Symptoms. In the 4 cases of mesenteric thrombosis among the 1600 necropsies at Johns Hopkins Hospital, to which Schley alluded, the diagnosis had not been made as they caused few symptoms or none at all. Ingebrigtssen also, recording the findings in 6 necropsies, states in 2 there had been no symptoms. The woman, of seventy-eight years, to whom Watson referred, was brought in unconscious after a fall in the street. The temperature was normal. There were no abdominal symptoms whatever during the three days till death. At necropsy there was thrombosis of the superior artery and 20 inches of dark red ileum.

DIAGNOSIS

Küssmaul, the first to diagnose embolism of the mesenteric arteries wrote:

"This diagnosis is to be made when, under circumstances permitting the assumption of embolism, intestinal bleeding, enteritis or peritonitis occur, without there being any cause for these manifestations." It is not so easily established apparently, for it was made but 13 times among the 360 examples collected by Trotter, and quoted so frequently in this article.

Marked leucocytosis is one of the outstanding features of the disease, a white count out of all proportion generally to the apparent severity of the illness (Warren and Eberhard).

In their report to the 1935 session of the French Surgical Congress, Ameline and Lefevre suggest that the blood picture is possibly destined to render much aid in the diagnosis. They too, call attention to the marked leucocytosis, especially of polynuclears. Indicanuria is stressed as a diagnostic aid by Smith. A distinction between arterial and venous type, even if possible, would be merely of academic interest.

Among the many previous preoperative diagnoses may be cited gastroenteritis, acute appendicitis, acute pancreatitis, strangulated hernia, typhoid perforation and torsion of an ovarian cyst.

PROGNOSIS

Prognosis is serious, the mortality in the first large series collected by Jackson, Porter and Quinby in 1904, was 92 per cent, at that time surgical therapy was not so common as at present. Though many years later, of Cokkinis' 76 instances there were 30 deaths, or 83 per cent, in the 36 operations, while in the 40 not operated on 39 died. This same author states of the 36 cases, the average duration of life from the onset was three days, omitting the 4 exceptional cases, and in 12 cases less than forty-eight hours. The duration evidently depends on the amount of bowel involved, though exceptions, as always are met; in one instance practically the entire bowel was involved in one day's time, in another only a few feet were affected after a lapse of a week. The venous obstruction is less dangerous, but as already stated is unfortunately less common.

Councilman was not very good as a prophet: He concludes his account of 3 necropsies by observing, "It is important to know that obstruction of the superior mesenteric may give rise to paralysis of the intestine, obstruction, and to peritonitis, and it is a condition which is beyond surgical interference," yet a few months later his fellow-citizen, Elliot, was the first to operate successfully for this type of lesion.

TREATMENT

Elliot's successful intervention was the first, though the fourth with operative treatment: A man of twenty-five years, with an inguinal hernia, taxis elsewhere some ten months prior was painful. At operation twenty hours after the onset, 48 inches of ileum were resected, with formation of an artificial anus, uniting the ends 17 days later. The specimen showed that the veins were involved.

At various times resort has been made to enterostomy, exteriorization, resection and simple exploration. The exact method followed, assuming this is adequate to dispose of the damaged bowel and the obstructed vessels, seems of less importance than the state of the necrotic intestine and how long absorption there has been from it. Acupuncture may be helpful, as in my case, for the escape of fluid blood shows the wall is probably viable.

In 69 cases by 43 different observers in the last fourteen years, there were no recoveries from 10 enterostomies nor from 4 exteriorizations. Of 9 attempts at secondary closure 4 recovered. In 18 laparotomies there were 6 successes; in 32 resections with immediate anastomosis 21 succeeded, according to Dunphy and Zollinger. Of Loobe's 9 operations on subjects aged twenty to sixty-four years, but one was successful, a woman, aged forty-six years; and 3 of Ross' 4 operations failed, while D'Abreu had no recovery

from his 2 exploratory operations and 3 resections.

Trotter states 11 cases were treated as in mine, by resection and end-to-end anastomosis with the Murphy button, and 5 recovered. In Bonnot's patient, a woman of twenty-eight years, the stay of the button was even longer than in my case, it was still in place at the end of the fifth week, but was passed in two days more.

The latest collection, by Ameline and Lefebvre in 1935 deals with a series of 450 collected cases, 87 deaths and 21 recoveries in 108 explorations; and 137 deaths with 93 recoveries in 230 resections, etc.

Some 30 simple explorations alluded by Trotter were all unsuccessful; nevertheless, in the case under the care of Wilson, at laparotomy a collection of firm nodular clots were found in the superior mesenteric vein completely blocking the lumen. Recovery ensued after closure of the abdomen and drainage. The success here though gradual, was evidently due to the inferior vein assuming the functions of its larger neighbor. Similar cases were those of a boy of ten years, reported by Laws, and a man of fifty-one years reported by Ross.

Still another instance of "spontaneous recovery" is recently furnished from South Africa by Sargent: A man of seventy-four years, was admitted with intense pain of sudden onset and about four hours' duration; no history of similar attacks or of abdominal disease; morphine addict for a long time. The pain was most severe just above and to the left of the umbilicus. At operation, a dilated loop of ileum some 48 inches long, with dark plum colored walls, bled very easily. The mesentery was much thickened and gangrenous in places. No pulsation was detected in the mesenteric vessels. Resection was decided as unwise because of the age, poor condition and length of the bowel involved. The abdomen was closed with as little handling of the contents as possible. Vomiting of clear, bile-stained fluid, persisted for three days and for three days more he hiccupped continuously. During this time the stools were slightly suggestive of melena. In a week "with dramatic suddenness" the pain, vomiting and hiccup ceased, the stools became normal, and a fortnight postoperatively had "almost completely recovered."

A few years since Sjovall successfully resected 4.5 meters of intestine for occlusion of the superior mesenteric artery in a woman of forty-four years. The temperature was normal on admission and pulse was 90. In this connection some other extensive resections are of interest: Flint, in 1912, collected 58 examples where over 200 cm. had been excised, 9 were unsuccessful. The most marked one was that of Brenner in which 540 cm. were removed for gangrenous hernia; the patient succumbed to inanition two and one-half years later. Since his article several others have been placed on record: 336 cm. in a youth of twenty years, reported by McGuire; 15 feet reported by Sarnoff. In a man of fifty-two years, Doerfler left 4.8 inches of the upper segment and 8 inches of the lower after operating for a volvulus, excising all the rest; 19 feet were removed by Jerauld and Washburn; 102¾ inches by Garner and Bisset, and 120 inches by Skinner. The last 6 cases were not done for occlusion, but the next 2 were, Wulsten removing all but 6 inches of jejunum, and 4 inches of ileum; and Banke excised 435 cm. in a man of forty-seven years but it was uncertain whether the arteries or veins were blocked.

Haymond has quite recently analyzed 257 examples of "massive resection" of the small intestine, that is, from 200 cm. to 800 cm. and up. Over half, or 143 cases had resections of 200 to 299 cm. There were 86 deaths or 33.5 per cent, and it is interesting to find that the largest resection of over 800 cm. was successful. Some 34 of the total number were for mesenteric occlusion with 14 deaths (41.2 per cent).

CASE REPORT

Mrs. M. V., aged forty-eight years was admitted June 20, 1935.

Past History: Diseases of childhood unimportant. Menarche at thirteen years, regular, very little distress. She was married at twenty-six, had had one abortion but no other pregnancy. Tonsillectomy was done at the age of thirty-six years. She had an attack of renal colic in 1917 when a small stone was passed; acute bilateral otitis media in 1928 with spontaneous drainage and complete recovery. A supravaginal hysterectomy for fibromyoma uteri, without removal of the ovaries, was done in 1933. One year later she had moderate gas pains for an hour or more at irregular intervals, but not severe enough to interfere with her work.

Present History: On June 18, she was awakened about 3 A.M. by severe pain referred to the epigastric region; aching in character and of steadily increasing intensity. When seen two hours later the pain was referred to the hypogastric region and to the right; the abdomen at this time was negative to palpation with no increase of pulse rate and normal temperature. As the patient described the pain as very similar to the renal colic of 1917, a definite diagnosis was deferred. However, there was no pain referred to either kidney and the urine was negative and no bladder irritation. Morphine was administered and a waiting policy followed. No vomiting till 3 P.M., when she tried some light nourishment. Morphine was given at 7 P.M. and she passed a quiet night.

She awoke at 7 A.M. with a recurrence of the severe, constant pain in the lower and right abdomen, but there was now added an intermittent colicky pain referred to left abdomen, independent of the constant pain on the opposite side. This combination was very confusing, in fact inexplicable. There was no rise in pulse rate or temperature. Morphine again relieved the suffering and she was fairly comfortable for the remainder of the day and night. There had been no vomiting except the one attack mentioned.

The next day the patient was seen at noon, she complained of severe pain of the same constant, intermittent type. Vomiting began at 7 A.M. and by 9 o'clock became fecal. She was now examined again: The abdomen showed moderate distention; a mass was felt in the midline rising nearly to the umbilicus and extending to the right inguinal region; this was tender, tense, about the size of a small fibroid and could not be displaced. There was still no increase in pulse or temperature. A diagnosis of intestinal obstruction combined with some obscure condition, more probably intussusception was made, though nothing supported this idea except the tumor. She was sent to the hospital. The admission temperature was 99°; pulse 94 and respiration 24. Blood-count showed 4,500,000 erythrocytes and 13,700 leucocytes, with neutrophiles 82 per cent and lymphocytes, 18 per cent. The urine showed no pathology.

Preoperative diagnosis. Acute intestinal obstruction.

Anesthetic. Morphine gr. ⅙, atropine gr. 100; ethylene, ether and oxygen.

Assisting surgeon. Gordon W. Abbott.

Examination of field under anesthetic: The scar from the former operation extended ⅓ of the distance from the umbilicus to the pubes. A firm and seemingly immobile mass could be felt in the midline to the right of and below the umbilicus; the abdomen slightly distended. The field was sterilized by iodine and draped.

Operation: A median incision, coextensive with and including the scar was made; great care was taken in opening the peritoneum to avoid the intestinal adhesion to the cicatrix; the normal intestinal loops were protected by gauze pads and some free fluid was removed from the abdominal cavity. A loop of small bowel was adherent to the upper end of the scar tissue and occluded; it was freed, carrying with it a piece of parietal peritoneum, restoring its lumen.

In the pelvis was a tense and adherent black mass, which extended to the right and was evidently the tumor felt during the examination. A syringe inserted into it withdrew dark blood. When the needle was withdrawn, gas escaped, indicating a gangrenous loop. This mass, evidently a part of the lower ileum, was bound down by velamentous adhesions to the surrounding structures. It was easily liberated, and drawn out of the abdomen and laid on moist gauze pads. The contents of peritoneal cavity were protected by additional moist pads. The affected portion was 30 cm. long and sharply demarcated.

Clamps were applied to the loop, 7.5 cm. from the gangrenous portion on each side, dividing the intestines between them; the mesentery was gradually cut to a V-shape, picking up vessels

as they were divided. No particular difficulty was encountered in controlling hemorrhage; an additional 8 cm. of proximal gut was removed with a part of the mesentery because of the doubtful blood supply. The mesentery was sutured and the bowel was reunited with a Murphy button. The distal loop at the point of union seemed too cyanotic, but pressure blanched it and circulation returned immediately on release, while the serous surface was shiny. The loop was returned to the cavity, and the ileum and cecum were found fully dilated. The wound was closed without drainage.

The report of the National Pathological Laboratories on the specimen was: "A large portion of resected bowel in two pieces, 8 × 2.5 cm., and 30 × 4.5 cm. The serosa is dull gray to crimson, markedly discolored by hemorrhages. On sectioning the vessels in the mesentery and in the bowel are distended with clotted blood. The mucosa is necrotic. *Microscopic diagnosis:* Acute hemorrhagic infarction with necrosis and acute purulent inflammation of intestine."

Postoperative course: Temperature ranged between 98° and 100°F. until the sixth day, when it rose to 102°; the wound was distended with a foul smelling, thin exudate which was removed. Moist dressings were applied after inserting a rubber tissue drain. On the ninth day, the temperature dropped to 98°, then ranged between 97° and 100° until fifteenth day, when 101° was recorded, to fall again next day to 98° then varied but slightly till discharge.

The passage of the button was not noted, but an *x*-ray on the twenty-fifth day, failed to show its presence. She left the hospital on the thirty-fourth day. Her history since has been uneventful.

Treatment: Preoperative enemas were without result. The stomach was irrigated with soda solution. Morphine sulphate, gr. ¼, was given an hour before operation. The pulse on return to her room was 140. Normal saline solution 1000 c.c. was given subcutaneously, followed an hour later by 1000 c.c. glucose intravenously. The pulse dropped rapidly and in twelve hours was 100. Respiration was not alarming at any time.

No postoperative enemas or Murphy drip were administered. Morphine was given through the fourth postoperative day, seven ¼ gr. doses being used. Lemonade *ad lib.* No nausea, gas pains or distention was evidenced. No nourishment taken until the fifth day, then chicken broth was given. The first light solid food was on the seventh day. The bowels moved spontaneously on the sixth day.

SUMMARY

This condition first recognized nearly a century ago, is uncommon, though not excessively so. For a long time it was merely a postmortem finding, but forty-odd years ago, Elliot was the first to record a successful intervention, the fourth attempt at surgical therapy. A few recoveries from simple exploration have been reported, but about half have been resected as in my case. The bowel was reunited by the Murphy button, and the convalescence was gratifyingly "smooth."

REFERENCES

Addison, O. L. *Brit. Jour. Surg.*, 173, (July) 1913.
Ameline et Lefebvre. *Presse Méd.*, 1587, (Oct. 12) 1935.
Banke, K. *Hospitalstid.*, 445, (March 10) 1932.
Blackburn, J. H. *South. Med. Jour.*, 810, (Nov. 1) 1916.
Bonnot, E. *Presse Méd.*, 502, (March 23) 1918.
Brady, Leo. *Arch. Surg.*, 151, (Jan.) 1923.
Brown and Dey. *Brit. Med. Jour.*, 186, (Jan. 30) 1932.
Cave, H. W. *Ann. Surg.*, 642, (Oct.) 1935.
Cawadias and Catsaras. *Lancet*, 949, (May 12) 1923.
Chiene, John. *Jour. Anat. and Physiol.*, 65, (Nov.) 1868.
Cokkinis, A. J. Mesenteric Vascular Occlusion, London: 1926.
Councilman, W. T. *Boston Med. and Surg. Jour.*, 410, (April 26) 1894.
Curry and Backus. *Jour. Am. Med. Assn.*, 839, (March 17) 1934.
D'Abreu, F. L. *Lancet*, 772, (April 9) 1932.
Doerfler, H. *Zentralbl. f. Chir.*, 1502, (Oct. 6) 1923.
Douglas, John. *Ann. Surg.*, 636, (Oct.) 1935.
Dunphy and Zollinger. *N. Eng. Jour. Med.*, 708, (Oct. 18) 1934.
Eisenberg and Schlink. *Surg., Gynec. and Obst.*, 66, (July) 1918.
Elliot, J. W. *Ann. Surg.*, 9, (Jan.) 1895.
Ferguson, C. D. *Brit. Med. Jour.*, 840, (May 7) 1932.
Finucci, V. *Annali Ital. di Chir.*, 144, (Dec. 31) 1931.
Flint, J. M. *Bull. Johns Hopkins Hosp.*, 127, (May) 1912.
Flynn, Charles W. *Texas State Jour. Med.*, 274, (Sept.) 1924.
Frank, Louis. *Am. Jour. Surg.*, 304, (Dec.) 1923.
Friedman, E. D. *Med. Record*, (Oct. 24) 1914.
Garner and Bisset. *Can. Med. Assn. Jour.*, 320, (Sept.) 1931.

[*For Remainder of References see p. 521.*]

SPONTANEOUS PERFORATION OF CARCINOMA OF STOMACH

ALEXANDER BRUNSCHWIG, M.D., F.A.C.S. AND THEODORE E. HEINZ, M.D.

Department of Surgery and Department of Medicine, University of Chicago Clinics

CHICAGO

SPONTANEOUS perforation of the stomach from carcinoma is relatively rare. The majority of reports of such cases are found in the European literature; relatively little has been written on the subject in America. Aird in a recent publication presents a comprehensive discussion of the question based upon 79 case reports, summarizing the literature. According to this author two-thirds of the cases of perforated gastric carcinoma are fulminant in their course, closely resemble perforated peptic ulcer in their symptoms and signs, and should be diagnosed as perforations of the stomach. In one-fifth of the cases rigidity was not pronounced or was totally absent. In one-third of the cases pain was slight or absent. The exact clinical diagnosis of perforated carcinoma rather than perforated ulcer is possible only if the gastric tumor has been previously diagnosed. In nearly one-half of the cases gross metastases were present when perforation occurred.

In connection with the question of surgical management of perforated gastric carcinoma the following case history is presented:

O. A., (132357) white male aged forty-two years, was admitted to the Medical Service of the University of Chicago Clinics, July 16, 1935. In 1925, severe burning epigastric pain developed about two hours after meals and would be relieved by eating or drinking milk, and aggravated by fruit juices. He also noted that the pain would improve with general rest and become aggravated by excess physical activity. In 1929, while under observation in another hospital he learned that taking an enema would relieve his pain, and on several occasions has resorted to this means for relief. There was no loss of weight, weakness or anorexia. On May 3, 1935 while in a street car he suddenly experienced very severe upper abdominal pain and found that he was unable to stand erect. He was seen by a physician who diagnosed perforated peptic ulcer and at another hospital a laparotomy was performed for repair of the perforation. At this time the carcinomatous nature of the lesion was appreciated by the operating surgeon but the writers were unable to obtain this information until after the patient was operated in this clinic. He was discharged ten days later in good condition and symptom free. During the latter part of June there was nausea on several occasions. Upon awaking in the morning of July 12, after sleeping well during the night, he experienced a strong desire to defecate, grew very dizzy and began to vomit blood and pass tarry stools. A physician administered an anti-coagulant and advised confinement to bed. During the three days prior to admission he was extremely weak but did not vomit; tarry stools continued.

On physical examination the patient appeared quite weak and pale, but mentally clear and cheerful; pulse 80, temperature 98°F. and respiration 22. There were no abnormal findings except the pallor and some constant tenderness and slight rigidity in the upper abdomen; there were no palpable masses. The blood pressure was 96/66. Red blood cell count was 3.600,000; hemoglobin 59 per cent; white blood cells 8,200; the urine was negative.

The clinical impression on admission was bleeding peptic ulcer. A regime of milk, cream and powders, with bed rest was instituted. The patient, however, continued to complain of severe burning pain in the epigastrium. A roentgenologic examination July 22 revealed an irregular crater about 4 cm. in diameter in the anterior wall of the gastric antrum and a constant duodenal bulb deformity. Gastric analysis showed free acid 5, total amount 15, no lactic acid or Boas-Oppler bacilli. Stool analysis for blood on three occasions revealed 4+ positive benzidine, two of these examina-

tions were made after two weeks on strict ulcer therapy.

The final clinical diagnosis made was carcinoma of the stomach and possibly an old duodenal ulcer.

On July 29, 1935, under ethylene-ether anesthesia the abdomen was entered by excision of the previous high midline incision scar. The stomach, quite mobile was brought through the wound and exhibited on its anterior wall at the junction of the lower third with the upper two-thirds a large disc-like, firm lesion about 6 cm. in diameter, to which considerable omentum was firmly adherent. The anterior wall of the first portion of the duodenum appeared cicatrized, but no evidence of active ulcer was present. There were many firm, enlarged lymph nodes in the mesenteries of the stomach but no evidence of liver metastases. A partial gastrectomy, with wide excision of adjacent mesenteries, was performed according to the Polya technique, removing approximately two-thirds of the stomach.

Convalescence was uneventful except for a sustained temperature of 102°F. for two days following operation due, undoubtedly, as chest roentgenograms revealed, to postoperative pulmonary atelectasis that involved a portion of the left upper lobe, which disappeared in a few days. The patient was discharged, seventeen days after operation, symptom free and on a general diet.

Pathologic Study. Gross. The lower two-thirds of the stomach removed, contains on the anterior wall in the midportion of the specimen a large crater, 4 cm. in diameter, with raised rolled edges and gray firm base, and surrounded by a wide zone of induration. Embedded in the crater are several loose sutures of non-absorbable material that were inserted at the time of the repair of the perforation. There are also several large open veins present in the floor of the lesion, into which a probe may easily be inserted. Some of these veins extend into the large mass of omentum that is adherent to the serosal aspect of the lesion.

Microscopic. Sections through the margin of the lesion show masses of carcinoma cells, many of them typical signet ring cells, invading all layers of the stomach wall. Sections of regional lymph nodes show partial to complete replacement of lymphoid tissue by carcinoma.

Pathologic Diagnosis. Colloid carcinoma of stomach, lymph node metastases.

The patient was last seen April 3, 1935,



Fig. 1. Photograph of ulcerating carcinoma of the stomach from specimen removed at operation two and one-half months following surgical repair of spontaneous perforation. In the left margin of the ulceration there remains a linen suture that was inserted at the first operation. In the floor of the crater are several patent openings into large veins.

apparently in good general condition and back at work. He stated that occasionally he has a clay colored stool. No masses are palpable in the abdomen. There has been a slight loss in weight.

DISCUSSION

In the series reviewed by Aird the immediate operative mortality from all types of surgical procedures was 50 to 60 per cent. The recorded results of various operative procedures are summarized by him as shown on page 510.

The results of primary gastrectomy appear far better than those obtained with other procedures, but to assume that this is the routine treatment of choice would not be justified. It must be remembered that such a procedure is attempted only in those

instances where the patient is in good general condition, where the neoplasm is small and when perforation is very recent. In evaluating the results presented in the above table it must also be borne in mind that "there is a tendency for solitary gastrectomy successes to be reported and for gastrectomy failures to be absent from the literature." From a theoretical standpoint, as emphasized by Aird, it would seem that the more conservative procedure would be closure of the perforation with gastroenterostomy if necessary, followed by a partial gastrectomy at a later date if no evidence of liver involvement was found at the first operation. The relative high primary mortality of partial gastrectomy for carcinoma as compared to that for gastrectomy for ulcer, would also tend to justify a conservative type of management for perforated carcinoma. Delaginière reported a case treated first by closure and later gastrectomy, that was well ten years following operation.

	Recovered	Died
Drainage alone	1	4
Closure alone	1	3
Closure and drainage	1	3
Local excision and closure	1	3
Closure and gastroenterostomy	5	7
Closure and jejunostomy	0	2
Jejunostomy only	0	1
Gastrectomy	7	0

SUMMARY

A case is reported as an example of the feasibility of conservative management and demonstrates the desirability of performing partial gastrectomy as soon as possible following recovery from closure of the perforation, and illustrates the dangers attendant upon long postponement of the partial gastrectomy.

REFERENCES

Aird, J. *Brit. Jour. Surg.*, 32: 545, 1934–1935.

Delaginiere, H. *Bull. et. Mem. Soc. de Chir.*, 49: 136, 1933.

REFERENCES OF DR. SMEAD*

21. Johnson, C. E. and Wies, C. H. Influence of ligation of pancreatic duct of dogs upon serum amylase concentration. *Jour. Exper. Med.*, *55*: 505–509, 1932.
22. Wohlgemuth, J. Ueber eine neue Methode zur quantitativen Bestimmung des diastatischen Ferments. *Biochem. Ztschr.*, 60: 1–9, 1908.
23. Foged, Jens. The diagnostic value of urine diastase. *Am. J. Surg.*, 27: 439–446 (March) 1935.
24. McCaughan, John M. The value of estimations of the amylase of the blood in the diagnosis of suspected pancreatic disease. *Surg. Gynec. and Obst.*, 59: 598–609 (Oct.) 1934.
25. Davison, W. C. A viscometric method for the quantitative determination of amylase. *Bull. Johns Hopkins Hosp.*, 37: 281–282, 1925.
26. Maslow, H. L. and Davison, W. C. A comparison of the viscometric, copper reduction, polariscopic and iodometric methods of measuring the rate of hydrolysis of starch and dextrin by aspergillus oryzae. *Jour. Biol. Chem.*, 68: 75–81, 1926.
27. Peterson, Lennart. A few words on the diagnosis and treatment of acute pancreatic diseases. *Zentralbl. f. Chir.*, 61: 333 (Feb. 10) 1934.
28. Hortolomei, M. N. The necessity of an operation in acute pancreatitis. *Bull. et mem. Soc. nat. d. chir.*, 59: 1180 (July 22) 1933.
29. Boshamer, K. Early diagnosis and therapy of acute pancreatic necrosis, *Med. Welt*, 8: 434, 1934.
30. Guleke, N. Diagnosis and treatment of acuet pancreatic necrosis. *München. med. Wchnschr.*, 80: 833 (June 2) 1933.
31. Parry, John R. and Murry, Kenneth. Acute pancreatic necrosis. *Can. Assn. Jour.*, 31: 6, 592–595 (Dec.) 1934.
32. Ehrmann, R. Zur Diagnose u. Therapie der akuten Pankreasnekrose. *Med. Klin.*, 26: 1363 (Sept. 12) 1930.
33. Judd, E. Starr. Personal communication. (July 1) 1935.

*Continued from p. 497.

MUCOCELE OF APPENDIX

REPORT OF TWO CASES, ONE CAUSING INTUSSUSCEPTION AND PARTIAL INTESTINAL OBSTRUCTION

THOMAS E. JONES, M.D. AND MORRIS G. CARMODY, M.D.

Cleveland Clinic

CLEVELAND, OHIO

VIRCHOW,[1] in 1863, was the first to recognize cystic dilatation of the appendix and Feré,[2] in 1877 was the first to designate this condition as mucocele. Since that time, Dodge[3] in 1916 collected 142 reported cases; Davison,[4] in 1922 added 18 cases from the literature and one of his own, and Mayo and Fauster[5] in 1932 reviewed 76 cases. Dannreuther[6] recently reported 8 cases which were found in a series of 8457 appendectomies in a ten-year period at the New York Post-Graduate Hospital. These, in addition to numerous sporadic reports have brought the total number of reported cases of mucocele of the appendix to approximately 400. Because of the comparatively rare occurrence of this condition and because of the unusual complications, such as invagination, intussusception and intestinal obstruction which occasionally accompany it, the following 2 cases are reported.

CASE REPORTS

CASE 1. The patient was a woman thirty-four years of age who was seen first at the Cleveland Clinic on September 1, 1933. She stated that she had been well until six days before, when crampy pains developed in the abdomen, which were most marked in the region of the umbilicus and in the right lower quadrant of the abdomen. She also noticed an urgency to defecate, but had not been able to secure a satisfactory evacuation. These symptoms were accompanied by nausea but no vomiting. Enemas made the pain temporarily more severe, but after expulsion of the enema, the discomfort was considerably although not completely relieved. Bowel movements also gave temporary relief. On two occasions, the pain radiated to the right axillary region. Otherwise, nothing of significance was revealed by the history.

Physical Examination. Examination of the abdomen revealed it to be flat and soft. The liver and spleen were not palpable. There was, however, an irregular tender mass the size of an orange which was palpable just below and to the right of the umbilicus. Considerable tenderness could be elicited in the region of the appendix.

The patient was admitted to the Cleveland Clinic Hospital for observation and study. A barium enema revealed the cecum to be redundant and the roentgenologist reported "an apparent inspissated fecal mass in the ascending colon which shifted into the cecum," and that "the colon is very spastic and the enema reproduced the patient's abdominal distress."

After the patient had been in the hospital for two days, she was discharged at her own request. The clinical impression at that time was that the patient was suffering from a partial intestinal obstruction of doubtful etiology.

Two weeks following discharge, the patient returned to the hospital complaining of the same symptoms as those at her first visit, and an exploratory operation was advised. This was performed on September 20, 1933. When the abdomen was opened, a tumor mass could be palpated in the middle of the transverse colon. Inspection revealed that an intussusception was present which involved the cecum and ascending colon. These structures had telescoped up into the transverse colon and produced the tumor mass. This condition was corrected in the usual manner, at which time it was then seen that the appendix was many times larger than normal, freely movable, and that it consisted of a fluctuant mass which involved the base of the cecum. The lower end of the cecum, including the appendix, was removed between Payr's clamps in such a way

as to maintain the normal opening of the ileum into the cecum (Fig. 1).

Pathological Examination. The specimen

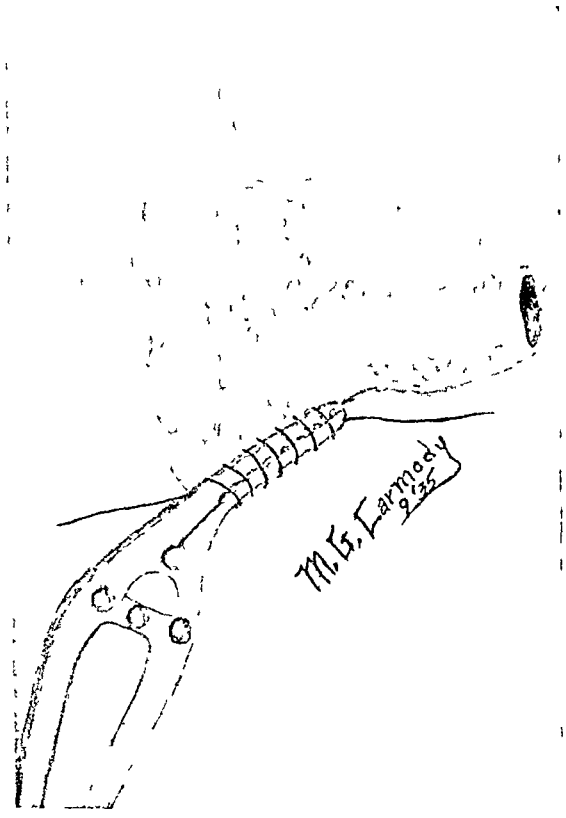


Fig. 1. Drawing showing use of Payr's clamps.

weighed 70 grams (Figs. 2 and 3). The opening of the appendix into the cecum was almost entirely closed over and the base of the appendix, which was greatly dilated, bulged into the lumen of the cecum. On opening the specimen, it was found to contain a large amount of tenacious, gelatinous, yellow, mucinous material.

Microscopic examination showed a greatly dilated lumen, with flattened mucosa, enlarged mucosal glands, very little lymphoid tissue, almost no recognizable submucosa, and a thin muscular coat which showed diffuse fibrosis and mild chronic inflammatory reaction. Another section through the appendix showed a greatly dilated lumen. The mucosa was represented by a straight line of columnar epithelial cells, not forming tubular glands and resting on a fibrous stroma. There was very little lymphoid tissue, almost no submucosa, atrophy and fibrosis of the muscular coat, and mild inflammatory reaction.

The pathological diagnosis was mucocele of appendix and chronic appendicitis.

It is quite apparent then that when the barium enema was given for the *x*-ray examination, undoubtedly the pressure in-



Fig. 2. Fig. 3.

Fig. 2. Photograph of specimen. (Case 1.)
Fig. 3. Photograph of specimen. (Case 1.)

side the colon reduced the intussusception, giving the examiner the impression that something was being pushed away.

Case II. The patient was a woman sixty-two years of age who was seen February 19, 1932, complaining of pain in the right lower portion of the abdomen which came on from one-half to one hour after meals. This pain was more severe after greasy foods had been eaten. This condition was associated with occasional vomiting and constipation. There was no gross hematuria or melena. Rectal examination revealed a firm mass anteriorly and to the right which was extrarectal. There was some tenderness in the left side of the pelvis. In the right lower quadrant in the region of the cecum, an ill defined mass could be felt. A complete hysterectomy had been performed in 1917. Cystoscopic examination revealed no abnormalities. Protoscopic examination revealed no direct or indirect evidence of neoplasm in the sigmoid. Roentgenograms of the gastrointestinal tract showed that the gall bladder was functioning normally. No pathology in the stomach, duodenum or colon was evident.

An exploratory operation was advised and this was performed five days after the patient was first examined. The urinary bladder was found to be soft and flabby and contained about 200 c.c. of urine; its walls were slightly thickened and its veins were rather prominent. It was felt that the ureters and kidneys were normal. The gall bladder was small, of normal thickness, contained no stones and emptied readily. The duodenum, pancreas and stomach

were normal. The spleen was small. The entire pelvis was well peritonealized, the tubes, ovaries, and uterus being absent. In the sig-



Fig. 4 Photograph of specimen. (Case II.)

moid and upper rectum there were two firm, movable nodules in the wall of the bowel, but these showed no gross pathology. They felt like calcified intramural nodules and were about the size of a navy bean or slightly larger. When the cecum was picked up, a tumor mass was felt laterally. The cecum, ileum and ileocecal valve were identified and then retracted; a tumor mass could be seen lateral to the cecum which was displaced medially.

This tumor mass was the size of a large sausage and it came off the lower part of the cecum where the appendix normally is found. It curved upwards and its tip was about the size of the distal portion of a little finger. Proximal to this tip, there was a nodular swelling from which the tip arose to curl towards the ascending colon. Grossly, it appeared as a mucocele of the appendix, and was removed. Following the operation, the patient made an uneventful recovery.

Pathological Examination. The specimen weighed 90 grams, was definitely cystic in nature and measured 8 cm. along each arm of its angular bend and varied from 2 to 4 cm. in diameter (Fig. 4). Gross examination showed it to be greatly distended and distorted in outline. It was bent upon itself to a 90° angle in its midportion and held in this position by strands of fibrous adhesions which extended over its surface. The serous surface, aside from a few old fibrous tags, was smooth and regular.

Longitudinal section (Fig. 5) showed it to be thin walled in its proximal portion and filled with gelatinous, opaque, yellowish-white, mucinous material. Its distal portion was filled with more firm, waxy mucinous material with yellowish-white areas of a finely granular character scattered through it.

Microscopic section revealed a very thin walled appendix with fibrosis of the peritoneal and submucous coats, atrophy of the muscular

Fig. 5. Photograph of specimen. (Case II.)

coat and a relatively flattened mucosa of very shallow glands with swollen epithelium and considerable mucus in the cells.

A pathologic diagnosis of mucocele of the appendix was made.

Both of these patients are in good health at the present time, and it is interesting that in neither case was there any evidence of pseudomyxoma peritonaei at the time of operation, so of course the prognosis as far as this is concerned should be excellent. We can derive nothing from the histories or clinical findings in either of these cases that gives indication of the duration of the condition before operation.

Etiology. As a result of an attack of acute appendicitis which has subsided spontaneously, it occasionally happens that a slow, obliterating process takes place. This is usually inflammatory in nature and occurs between a secreting area and the base of the appendix. Lifvendahl and Ries[7] have indicated that complete occlusion is not always necessary to produce this condition. They also question another time honored prerequisite for the development of this condition which was set forth by Elbe,[8] namely, that a sterile lumen is necessary. These writers conclude that pathogenic organisms may have access to a mucocele without causing peritonitis, empyema, or gangrene of the organ. The predisposing inflammatory changes may be the result of such specific conditions as tuberculosis, syphilis and carcinoma, or of such mechanical factors as angulation and

gradual torsion by adhesions. If the original infection remains of such a low grade intensity that the mucous secreting cells are stimulated, the obliterated appendix then becomes distended with mucus which is secreted in excess of its absorption.

Associated with the condition, some physiologic alteration must occur in the mucosa whereby the normal mucus becomes changed to pseudomucin. It is probable that the secretion is at first mucoid, and in connection with this, there may be thickening of the mucosal and muscular coats. Later, the effects of continued pressure from within make themselves evident on the cyst walls and further products of hyaline or myxomatous degeneration of the fibrous elements are added which possibly lead to the gelatinous character of the contents. As the pressure becomes greater, herniations of the mucosa through the thin muscular coat may occur, producing small diverticuli. Such distension of the appendix may increase slowly until the organ becomes many times its normal size.

Size. Most mucoceles are globular in shape and a few reach an enormous size. Neumann[9] described one the size of a man's head in a patient sixty-nine years of age. Further progress in the distension of the organ may be interrupted at any stage by rupture of one of the diverticula and this results in a collapse of the appendix and the extrusion of mucus into the peritoneal cavity. The ruptured diverticulum then heals and an identical process begins over again.

Symptoms. This sequence of enlargement and rupture of diverticula may be repeated a number of times before clinical signs or symptoms are produced, and in many instances, the symptoms either are absent or obscured by other conditions. The patients usually complain of vague and indefinite distress in the right iliac fossa. Occasionally, a mass is palpable and a diagnosis of an ovarian cyst or intestinal tumor may be made. In a few rare cases, the appendix may become invaginated and cause symptoms of intestinal obstruction.

Diagnosis. A diagnosis of mucocele of the appendix seldom is made prior to exploratory operation or necropsy, although this may be said, a palpable mass in the region of the cecum, which is movable, only slightly tender, and is not associated with fever, weight loss, anemia or gastrointestinal disturbances other than perhaps a vague discomfort in this region, should always lead one to suspect the presence of a mucocele of the appendix.

Treatment. Appendectomy, of course, is the only treatment available and this should be performed as early as possible, before the mucin has spread too widely within the peritoneal cavity. As stated before, appendectomy does not always cure the condition in which case, death ensues sooner or later.

The method of treating Case 1 is interesting and worth remembering. That is, the lower end of the cecum was included and removed with the involved base of the appendix between Payr's clamps in such a way that the normal opening from the ileum was maintained (Fig. 1). Then by using a Parker-Kerr basting stitch and removing the Payr's clamp, the opening in the cecum was closed. This area was then reinforced by serosal sutures.

Complications and Prognosis. The most common and most important complication of mucocele of the appendix is its rupture. The extruded mucus is not absorbed but becomes implanted on the peritoneal surfaces in the form of droplets, which are encapsulated by a growth of filmy connective tissue, produced as a result of the localized peritonitis. This condition is known as pseudomyxoma peritonaei and is analogous to that which occurs from the rupture of a pseudomucinous cystadenoma of the ovary. The production of mucus within the peritoneal cavity from a mucocele of the appendix may be checked by removal of the organ. In a few cases, however, appendectomy has no influence on the condition. In such instances of pseudomyxoma peritonaei, large gelatinous globular masses of viscid, mucoid material which resemble masses of frog's spawn, form and penetrate every part of the peritoneal cavity. The abdomen becomes mark-

edly distended by this newly produced material. The distention is often great enough to interfere with respiration. It is evident that such a process necessarily becomes a type of malignant growth. The explanation of this apparent anomaly probably is that epithelial cells become implanted upon the peritoneal surfaces and continue to reproduce the gelatinous, mucinous material of the original growth, or that possibly the presence of the material acts as an irritant to the peritoneum and causes it to react by further production of similar masses. The prognosis then becomes unfavorable, although repeated operations may secure relief for a number of years. Death finally comes as a result of either sepsis, embolism or intestinal obstruction, the latter being caused by the formation of adhesions.

Masson and Hamrick[10] believe that the prognosis in pseudomyxoma peritonaei of appendiceal origin should be better than that of ovarian origin in that the exudate remains limited to the right iliac fossa in the former instance.

Some other complications of mucocele of the appendix are intussusception, invagination, volvulus, intestinal obstruction and occurrence in hernial sacs. Mulsow,[11] Squires,[12] and Hall[13] have reported cases in which the mucocele had invaginated into the cecum and caused obstruction at the ileocecal valve. In the case reported by Mulsow, gangrene of the cecum and proximal portion of the appendix had occurred. Martin[14] described a case of intussusception caused by mucocele of the appendix in which the intussusception had extended to the middle of the transverse colon.

SUMMARY

1. Two cases of mucocele of the appendix are reported, one of which caused intussusception and partial intestinal obstruction in an adult. Complete recovery followed operation in each case.

2. Mucocele of the appendix is a rare, chronic condition which is seldom diagnosed before operation or necropsy. Its presence should be suspected in any case in which there is a movable palpable mass in the region of the cecum which is not associated with fever, loss of weight, anemia or gastrointestinal disturbances other than vague discomfort in this region.

3. Surgical removal of the appendix is the only method of treatment, and should be done as early as possible before pseudomyxomatous peritonaei develop which nearly always terminate fatally.

4. Other complications associated with mucocele of the appendix are intussusception, invagination, volvulus, intestinal obstruction and gangrene.

5. Surgical treatment may necessitate partial resection of the cecum as was necessary in Case 1, and the surgeon should be prepared to follow this procedure if it is necessary.

REFERENCES

1. Virchow, Rudolph. Die krankhaften Geschwülste, Berlin, A. Hirschwald, 1863–1867.
2. Feré. Mucocele de l'appendice ileocaecal. *Progrès med., Par.* 5: 73, 1877.
3. Dodge, George E. Cystic dilatation of the vermiform appendix. *Ann. Surg.*, 63: 334–343, 1916.
4. Davison, M. Mucocele of vermiform appendix, *Internat. Cl.*, 2: 303–309, 1922.
5. Mayo, C., Jr. and Fauster, J. U., Jr. Mucocele of appendix with report of case. *Minnesota Med.*, 15: 254–256 (April) 1932.
6. Dannreuther, W. T. Mucocele of the vermiform appendix. *Ann. J. Obstet. & Gynec.*, 31: 342–349, 1936.
7. Lifvendahl, R. A. and Ries, E. Open communication between mucocele and cecum. *Am. J. Surg.*, 17: 270–274 (Aug.) 1932.
8. Elbe, Stabsarzt. Appendixcysten und Divertikel, *Beitr. z. klin. Chir.*, 64: 635–711, 1909.
9. Neumann, Alfred. Pseudomyxoma peritonei ex processu vermiformi. *Berl. klin. Wchnschr.*, 46: 15–19, 1909.
10. Masson, James C. and Hamrick, Robert A. Pseudomyxoma peritonaei originating from mucocele of the appendix. *Surg. Gynec. Obst.*, 50: 1023–1029 (June) 1930.
11. Mulsow, F. W. Mucocele of the appendix with diverticulum and invagination into cecum. *Tr. Chicago Path. Soc.*, 13: 434–435 (June) 1931.
12. Squires, C. D. Mucocele of appendix. *New York State J. Med.*, 31: 285–286 (March) 1931.
13. Hall, D. P. Mucocele of appendix with mass in cecum. *Internat. J. Med. and Surg.*, 47: 169–172 (April) 1934.
14. Martin, E. K. Mucocele of appendix, Atlas of pathological anatomy. *Brit. J. Surg. (supp.)*, 21: 354, 1934.

RECURRENT INTESTINAL OBSTRUCTION DUE TO GALLSTONE

WILLIAM H. MAST, M.D.

GUNNISON, COLORADO

INTESTINAL obstruction due to gallstones was first reported by Bartholin in 1654 and since that period various reports may be found. While not rare, the occurrence is seldom found oftener than once in 30,000 to 70,000 surgical cases. The incidence among the total cases of intestinal obstruction is estimated to lie between 0.5 and 2 per cent.

Stones may enter the bowel either by passage from the gall bladder through a dilated cystic or common duct, or by ulceration through the gall bladder and subsequent perforation into the bowel. A history of jaundice naturally points to the former type of mechanism. Ulceration through the gall bladder or perforation into the bowel may be followed by a localized or general peritonitis; and death result due to insufficient adhesions protecting the fistulous tract.

If a stone successfully enters the bowel by either route and causes mechanical obstruction, the diagnosis becomes difficult and is rarely made prior to operation. The onset of vomiting and the acute nature of the obstruction usually preclude gastrointestinal study. A flat *x*-ray plate of the abdomen may be of value at times. Many of these cases are seen late in the disease and the loss of fluids and the existent toxemia renders any surgical procedure quite formidable. A mortality of 60 to 70 per cent attends surgical intervention.

The following case seems to be of interest for three reasons: (1) the probable time that perforation of the gall bladder by the gallstone occurred can be conjectured; (2) the ball-valve type of obstruction caused by the gallstone, resulting in repeated attacks of intestinal obstruction apparently relieved by movement of the stone; and (3) the rapid loss of weight and marked gastrointestinal symptoms present for one year.

Mrs. B. A., white female, aged sixty years, entered the hospital on August 15, 1935, with a chief complaint of pain in the lower abdomen and vomiting.

Present Illness. During the past year patient noticed obstinate constipation associated with flatulence and sour eructations. Every twenty to thirty days during this time she had experienced acute attacks of pain in the epigastric region and left lower abdomen, accompanied by distention and protracted vomiting. These attacks were preceded by obstipation for three to four days and lasted about ten days. They were never relieved until the bowels moved, either after repeated enemata or numerous cathartics. There had been no diarrhea and she had never been jaundiced. Her appetite had decreased and during the past six months her diet was chiefly liquid. The average weight one year ago was 130 lbs. (59 kg.), the weight on admission was 74 lb. (33.6 kg.).

Two weeks prior to admission, the patient experienced a typical attack of pain and vomiting as described. She stated that her bowels had not moved during this time and that vomiting occurred every one to two hours. Pain in the epigastrium and left lower quadrant had been colicy in nature and grown more intense. She had received no medical attention as she lived seventy miles distant in an inaccessible part of the country.

Family history was essentially negative.

Past History. Menopause at fifty-two years was normal. She has had indigestion for ten years, qualitative in nature, with fulness and sour eructations after meals. At the onset of these symptoms she was examined by a physician, who told her that she had gallstones. No *x*-ray study was made. Four years later she experienced a sudden pain in the right upper quadrant associated with nausea and vomiting; abdominal distention and generalized pain were quite marked, and her condition became

critical for several days. There was no jaundice, coffee ground vomitus, tarry or clay colored stools. This illness lasted about ten days and the third and fourth days large quantities of fecal material were passed after frequent enemata. The patient was greatly improved

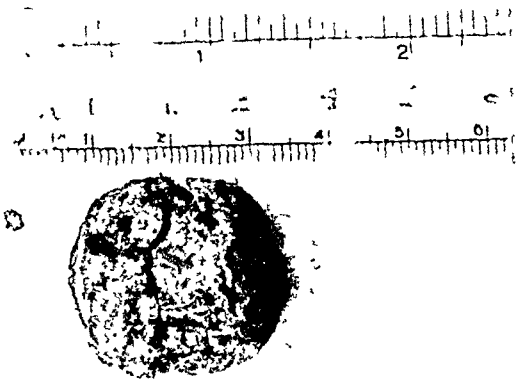


Fig. 1A. Gallstone causing recurrent intestinal obstruction.

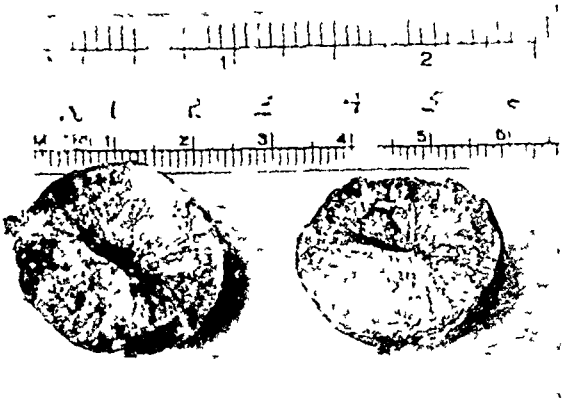


Fig. 1B. Note layer of fecal impaction about original stone.

required morphine a number of times for relief. She had been free from pain until the onset of present illness one year ago.

Physical examination revealed a small woman, extremely ill, weighing 74 lb. (33.6 kg.). There was an obvious loss of panniculus, and extreme dehydration was evidenced by her dry skin and tongue. No jaundice was present. The pupils reacted to light and accommodation. Examination of the heart and lungs was negative. There was no adenopathy and the thyroid gland was not enlarged.

The abdomen was markedly distended and tympanitic, with generalized tenderness and involuntary rigidity. Rectal and pelvic examinations were negative.

The temperature on admission was 100.4°F., pulse 120 beats per minute and weak. The leukocytes numbered 21,300 with 87 per cent polymorphonuclear cells. The erythrocytes numbered 4,280,000, and the hemoglobin was 80 per cent, (Tallqvist). A catheterized urine specimen revealed a 3 plus albumin with 3 plus pus cells and many hyaline and granular casts.

A diagnosis of acute intestinal obstruction, probably due to malignancy of the bowel, was made. However, the patient was too critically ill to consider surgery at that time. Dehydration was combatted with intravenous and subcutaneous fluids. The Wangesteen continuous intestinal drainage was instituted with rapid relief of the distention and pain.

On the second day a small bowel movement was effected by an enema. Examination of the stool was negative for occult blood. During by the third day. The distention and pain had subsided, and after removal of the duodenal tube, she could retain liquids. For the next week she continued to improve and wished to go home. She refused gastrointestinal *x*-ray study and was dismissed without a definite final diagnosis

One month later the patient was readmitted with a history of a recurrence of acute symptoms of one week's duration. She was not as dehydrated as on her previous admission, but she was extremely ill. A flat *x*-ray plate of the abdomen showed a small intestine obstruction, and the patient was prepared for surgery.

Under ether anesthesia, a low left rectus incision was made. Nearly 800 c.c. of straw colored fluid was present in the abdomen. A hard mass the size of a large marble was found completely occluding the ileum about 24 inches from its origin. The small bowel above this point was distended to three times its normal size and markedly engorged. Below the obstructing mass the bowel was collapsed. An intestinal clamp was applied above and below the mass, and the bowel opened by a longitudinal incision 2 inches in length opposite the mesentery. The mass was delivered and the intestinal mucosa was found to be smoothed out at this point. The intestinal incision was closed in the usual manner and an enterostomy was performed 8 inches proximal to the site of obstruction. Examination of the mass at the time of operation showed it to be a gallstone. (Figs. 1A and B.)

The abdominal incision was enlarged and the liver and gall bladder quickly explored, as the

condition of the patient was poor. The gall bladder was a hard contracted mass, about 1¼ inches (3.3 cm.) long and ½ inch (1.3 cm.) in diameter with numerous dense adhesions between the gall bladder, stomach and duodenum. The cavity was obliterated and contained no stones. On the lateral margin of the second portion of the duodenum could be seen an ill defined depression which apparently marked the point of entrance of the stone into the duodenum. The incision was closed in layers without drainage.

Examination of the specimen showed it to be a cholesterin stone, measuring 3 × 2¾ cm. and weighing 153 grains. There was a hard, smooth fecal layer, from 2 to 4 mm. in diameter, firmly adherent to the stone.

The postoperative convalescence was uneventful. The patient was out of bed within two weeks and left the hospital at the end of the third week. Two months later she reported a gain of 12 lb. (5 kg.), and stated that her former symptoms and constipation have not recurred.

COMMENT

The prolonged acute attack of right upper quadrant pain, as described, which the patient experienced a number of years previously, was probably the time that rupture of the stone from the gall bladder occurred. Movement of the stone down the intestinal tract was slow and seemed to be associated with frequent obstruction in which the gallstone acted as a ball-valve.

CONCLUSION

1. A case of intestinal obstruction from a gallstone is presented.
2. The approximate time of perforation from the gall bladder can be conjectured.
3. The rapid loss of weight, simulating a malignancy, together with recurrent attacks of intestinal obstruction from the stone, are of unusual notation.
4. Any case of intestinal obstruction with a previous history of gallstone colic may have an impacted gallstone in the intestinal tract. If this be kept in mind, this condition will be overlooked less frequently.

ISCHEMIC NECROSIS FROM ICE BAG "BURN"

GEORGE H. BUNCH, M.D.

COLUMBIA, S. C.

DEATH from exposure to cold has always been the fear of explorers in arctic regions and in high altitudes. Except in the feeble and in the chronic alcoholic, deaths from freezing are rare in the temperate zone, but chilblain, frost-bite and necrosis from cold are not uncommon. That ischemic necrosis of the superficial tissues may be caused by the therapeutic application of an ice bag is not generally appreciated even by physicians. In the literature available, practically nothing is found on it. Although not of paramount importance it merits consideration for the general use of the ice bag makes the subject of more than academic interest. Figure 2 shows ischemic necrosis of the abdominal wall of a well nourished young negress following the continuous application for five days, in midsummer of an unprotected ice bag for the relief of pelvic inflammation of tubal origin.

That heat and cold being so entirely different in character and in activity should produce, when applied locally, tissue changes that are almost identical is surprising. In each, three degrees of reaction are recognized by clinicians and by pathologists: (1) hyperemia; (2) bleb or blister, and (3) necrosis or gangrene.

When cold is applied there is a preliminary anemia of the part which is followed by a hyperemia. Each stage progresses into the next if the local application is of sufficient degree and duration. In ordinary cases of frost-bite as explained by Boyd[1] the main factor in the production of the gangrene is the ischemia due to extreme contraction of the blood vessels, together with damage to the capillaries with the formation of hyaline thrombi. "If the cold is sufficiently great the fluid of the cells is crystallized, and the cells are torn to pieces by ice crystals." MacCallum[2] says the noxious effect of freezing is explained either as due to tearing of the cells as the ice crystals are formed, or to the concentration of the salt around the crystals, or to the withdrawal of water from the cell to form ice. However, he attributes the gangrene of the extremities following exposure to cold as the result of protracted ischemia from extreme contraction of the blood vessels or their obstruction from thrombi. Adami[3] writes,

> It is not the active freezing of the tissues that induces cell death but the subsequent too sudden reestablishment of the circulation, with resultant paralytic dilatation of the vessels, intense exudation, and circulatory stasis leading to malnutrition. . . . That it is the vascular disturbance that is at fault and not the primary death of the cells through the freezing process is further indicated by the fact that similar gangrene may affect the extremities of those with enfeebled circulation, alcoholics etc., from mere immersion in cold water—i.e. above the freezing temperature.

That some kinds of fish may be frozen in solid ice and revive apparently unharmed when the ice melts is explained by the fact that the concentrated plasma in them freezes only at temperatures much lower than the freezing point of water. If the plasma freezes the fish die.

In the human the effect of exposure of a part to cold varies with the degree and the duration of chilling that results. Loss of heat from wet clothes, by conduction is much more rapid than by radiation from exposure to the atmosphere, although the ears, the nose, the cheeks and the fingers readily freeze when unprotected in cold,

[1] BOYD. Text Book of Pathology, 2nd Edition, 353.

[2] MACCALLUM. Text Book of Pathology, 1916 Edition, 369.

[3] ADAMI. Principles of Pathology, 2nd Edition, Vol. 1, 287.

windy weather. Freezing anesthetizes the skin so that the condition is often recognized first by the characteristic blanching.

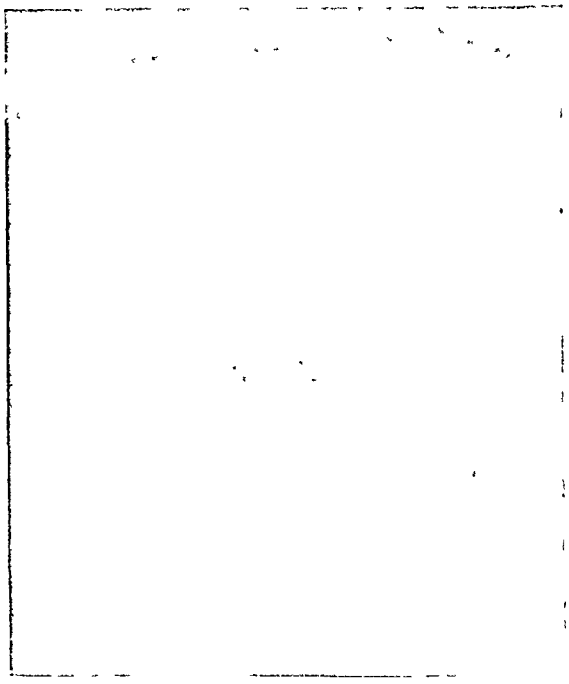


Fig. 1. First stage, hyperemia from two days continuous application of unprotected ice bag to right abdomen for appendicitis in white girl.

Because of the depressing effect on both the circulation and the sensory nerve endings, cold has for many years been used in the local treatment of inflammation of the active type. In order that the tissues shall be subjected only to the proper degree of cold the patient should be under close supervision. Too severe or too prolonged therapy lessens tissue vitality and hinders repair. Resistance of the body to cold varies with the age and the vigor of the individual; resistance of a part to cold varies with the blood supply but any area of skin may be frozen if the degree and the duration of exposure is sufficient. However, increasing experience has convinced me that cold has but little place in the treatment of inflammation in general surgery. I have yet to see a case of acute appendicitis relieved by the application of an ice-bag. The course of the disease is not effected and the symptoms are not abated. The custom of using an ice bag on every case of appendicitis before operation is a fetish of the past without practical merit. Any good derived from it is psychic, not physical.



Fig. 2. Third stage, ischemic necrosis of skin and superficial tissues from five days continuous application of unprotected ice bag to the abdomen of well nourished negress for relief of pelvic peritonitis.

There is no such thing as "freezing out" an attack of appendicitis. From the hyperemia caused by the use of the bag there is an increased tendency to bleed at operation.

But if an ice bag is to be used proper application and care of it are necessary to protect the tissue from ischemia and burn. The bag must not come into direct contact with the skin, but one or more thicknesses of soft cloth or towel should be placed between the skin and the bag. The cloth not only acts as an insulating medium and moderates the degree of cold to which the skin is exposed but its greatest service is absorbing the moisture which condenses on the bag from the warm air of the room. It keeps the skin dry in this way. A leaky bag should never be used. There is a layer of air between a dry bag and the skin that tends to prevent freezing. When a wet bag is next to the skin this protecting layer of air is replaced by water and the loss of heat by conduction is much greater. The bag should not be kept on continually. After

two hours it should be removed for an hour and then reapplied. Some medical students say these principles are taught them in school. I find but little about them in surgical literature.

The treatment of ischemia from cold varies with the lesion. The effected part should be warmed very slowly. Any one who has ever been very cold has experienced the extreme pain caused in an extremity by warming the part too quickly. The white and bloodless tissue becomes red and swollen after thawing. The pain is from the reaction of the arteries to the sudden release from contraction and is best relieved by plunging the extremity into ice water or by rubbing it with snow. However, if the cells have crystallized from cold they are dead and care in thawing the effected part is of no avail. In the hyperemic stage of ice bag burn no treatment is necessary. In the bleb stage some mild antiseptic solution like mercurochrome may be applied. In the necrotic stage the treatment is that of necrosis from heat. Gangrene of an extremity is usually of the dry variety and amputation should be done when a line of demarkation forms.

SUMMARY

That an ice bag applied continuously may cause local tissue necrosis is not appreciated by physicians. The common use of the ice bag in the treatment of deep seated inflammation of the active type makes the possibility of burn from it of more than academic interest. The way in which local cold causes necrosis is discussed. The proper application of an icebag, to prevent burn, with one or more thicknesses of cloth between it and the skin to keep the skin at all times dry is explained. The necessity for slow warming of tissue after exposure to cold is noted.

REFERENCES OF DR. BROWN*

Haymond, H. E. *Surg., Gynec. and Obst.*, 693 (Nov.) 1935.
Hedlund, J. A. *Hygeia*, 17: 875, 1917.
Henle, J. "Handbuch d. Systemat. Anat. d. Menschen," III (Gefässlehre) 161, 163. Braunschweig: 1868.
Ingebrigtssen, R. *Norsk Mag. f. Laegevid.*, 76: 341, 1915.
Jackson, Porter and Quinby. *Jour. Am. Med. Assn.*, 1469, 25, 110, 183 (June 30, July 2, 9, 16) 1904.
Jerauld and Washburn. Ibid. 1827 (June 1) 1929.
Klein, Eugene. *Surg., Gynec. and Obst.*, 381 (Oct.) 1921.
Kojeff, H. *Zentralbl. f. Chir.*, 1672 (July 9) 1932.
Küssmaul, A. *Würzburg. med. Ztschr.*, 5: 210, 1864.
Lagane, Louis. *Presse Méd.*, 1025 (Dec. 23) 1921.
Larson, L. M. *Surg., Gynec. and Obst.*, 54 (July) 1931.
Laws, G. M. *Ann. Surg.*, 378 (Sept.) 1916.
Loope, R. G. *Jour. Am. Med. Assn.*, 369 (July 30) 1921.
Lothrop, H. A. *Boston Med. and Surg. Jour.*, 557 (Dec. 6) 1894.
MacCornack, R. L. *Wisconsin Med. Jour.*, 702 (Oct.) 1932.
Mauclaire et Jacoulet. *Arch. gén. de Chir.*, 213, 341 (Feb., March) 1908.
Maylard, A. E. *Brit. Med. Jour.*, 1454 (Nov. 16) 1901.
McClanahan, B. V. *Illinois Med. Jour.*, 514 (June) 1926.
McGuire, E. R. *Surg., Gynec. and Obst.*, 40 (Jan.) 1913.
Melchior, E. *Zentralbl. f. Chir.*, 3088 (Dec. 3) 1927.
Munro, Dr. *Lancet*, 147 (Jan. 20) 1894.
Ochsner, Alton. *Ann. Surg.*, 643 (Oct.) 1935.
Ophüls, William. Stanford U. Med. Publications I: No. 3, 1926.
Poirier, Paul. in Traité d'Anat. Humaine, Poirier-Charpy. 2me Ed. II, 779. Paris: 1901.
Reich, Anton. *Ergebn. d. Chir. u. Orth.*, 7: 515, 1913.
Rixford, Emmett. *Ann. Surg.*, 643 (Oct.) 1935.
Robey, W. H. Med. Clinics of N. Amer., 121 (July) 1920.
Ross, George G. *Ann. Surg.*, 121 (July) 1920.
Sargent, R. M. *Brit. Med. Jour.*, 64 (July 14) 1934.
Sarnoff, Jacob. *Ann. Surg.*, 745 (Dec.) 1923.
Saxer, Fr. *Zentralbl. f. Allg. Pathol.*, 13: 577, 1902.
Schley, W. S. *Ann. Surg.*, 252 (Aug.) 1911.
Selby, H. J. *Brit. Med. Jour.*, 757 (May 5) 1928.
Sjovall, S. *Acta Chir. Scandinav.*, 61: 577, 1927.
Skinner, H. L. *Ann. Surg.*, 788 (March) 1931.
Smith, Wilburn. *Calif. and West. Med.*, 308 (May) 1930.
Taube, N. *Jour. Am. Med. Assn.*, 146 (May 2) 1931.
Tiedemann, F. T. Von d. Verengerung u. Schliessung d. Pulsadern in Krankheiten," Heidelberg: 1843.
Trotter, Leslie C. Embolism and Thrombosis of the Mesenteric Vessels, Cambridge: 1913.
Warren and Eberhard. *Surg., Gynec. and Obst.*, 102 (July) 1935.
Watson, F. S. *Boston Med. and Surg. Jour.*, 552 (Dec. 6) 1894.
Wilson, K. J. G. *Med. Jour. Australia*, 386 (Dec. 13) 1923.
Wulsten, J. *Zentralbl. f. Chir.*, 3155 (Dec. 14) 1929.

Continued from p. 507.

POSTTRAUMATIC THROMBOSIS OF INTERNAL CAROTID ARTERY*

REPORT OF TWO CASES

JOHN A. CALDWELL, M.D., F.A.C.S.

Professor of Clinical Surgery, University of Cincinnati College of Medicine

CINCINNATI

IT MAY be difficult to evaluate the cerebral symptoms following traumatic thrombosis of the internal carotid artery, especially if the injury has been associated with a head injury, for the latent paralysis or aphasia may be attributed wrongly to the head injury. This occurred in one of our patients. Another instance was reported very fully in 1872 by M. Varneuil[1] of Paris. In his case the cerebral symptoms, consisting of right hemiplegia and aphasia, were attributed to the head injury until necropsy revealed a propagating thrombosis of the internal carotid artery and its branches.

Makins,[2] DaCosta,[3] Reid[4] and others report an incidence of cerebral complications in 20 to 30 per cent of the cases following ligation of the common or internal carotid arteries. The incidence of such symptoms is undoubtedly much greater following a widespread propagating thrombosis of these vessels as a result of contusion, laceration or fracture of the artery, although too few cases hgve been reported to permit the establishment of any accurate percentage figures. The late development of the cerebral symptoms and signs is undoubtedly of great significance in making a differential diagnosis. The main reason, however, for recording our 2 cases is the frequent error of attributing to concomitant head injuries the symptoms and signs which develop as a result of a traumatic thrombosis.

CASE 1. A colored male, sixteen years old, whose history was obtained from relatives. About ten hours before admission to the hospital, the patient fell on a hedge and received a penetrating wound of the soft palate. The immediate result was a moderate amount of bleeding, local pain and swelling but no loss of consciousness. Four hours later his physician examined the wound and recommended hot gargles. A few hours later the patient vomited, was unable to gargle, became drowsy and could not talk although he apparently understood what was said to him. As a result of increasing drowsiness and the development of a weakness of the right side of his body, he was brought to the hospital. Prior to the injury the boy was a normal, healthy child.

Physical Examination. The patient was well developed and nourished, quite drowsy but when aroused attempted to cooperate although he was unable to speak. His temperature was 99.8, pulse 88 and respiration 20. The skin was normal and the head showed no external signs of injury. The right upper eyelid seemed to droop and the patient could not completely close the right eye. The pupils were normal; there was no nystagmus; the corneal reflex was diminished on the right; the fundi appeared normal. The ears and nose were negative. There were twitching movements of both lips on the right side and he would not protrude his tongue. A jagged wound 2 cm. in diameter was seen in the roof of the mouth at the junction of the hard and soft palate, slightly to the left of the midline. There was no rigidity of the neck. The lungs and heart were essentially normal. The blood was pressure 130/60. The right arm showed a flaccid paralysis, while the right leg was somewhat spastic and moved very little even on painful stimulation. The deep reflexes in the right arm and right leg were hyperactive. Babinski, Oppenheim, and Chaddock signs were positive on the right side. The right abdominal and right cremasteric reflexes were absent.

The spinal fluid on admission contained no increase of cells or protein. There was no

* From the Department of Surgery of the University of Cincinnati and the Cincinnati General Hospital.

increase of pressure and the Queckenstedt sign was normal. The patient had three other spinal punctures, the last done three days after admission, which showed a cell count of 700 cells per cmm. The white blood count was 15,000. The patient was incontinent and no analysis of the urine was made. The Kahn test and the spinal fluid Wassermann were negative. A roentgenogram of the skull revealed no fracture.

Course in Hospital: The temperature rose slowly, one time reaching 103°F., accompanied by a slow pulse and his stupor increased. He developed rather marked tenderness on the left side of his neck just below the ear with a very perceptible decrease in the carotid pulsation. The drowsiness increased and the patient died six days after admission to the hospital.

At the necropsy the left internal carotid contained a well formed thrombus which extended from the cervical portion of the artery into the cranial portion and on into the middle cerebral and sylvian arteries. The left cerebral hemisphere was softer than the right and on section a hemorrhagic infarct was found in its central portion.

Case II. A negress, aged twenty-four years, was shot in the face, the bullet notching the right mandible. The patient was admitted in shock but reacted favorably to stimulation and the administration of salt and acacia solutions. The following day there was marked swelling in the posterior pharyngeal wall and epiglottis and she had considerable obstruction to respiration. A tracheotomy was considered.

A roentgenogram showed the notch in the lower margin of the right mandible and the flattened bullet lying to the right and in front of the third cervical vertebra.

Five days after admission examination revealed a Horner's syndrome of the right eye. Ophthalmoscopic examination showed some pallor of the right fundus, but no other abnormality.

Thirteen days after admission examination revealed a left hemiplegia involving face, arm and leg, with hyperactive reflexes and an ankle clonus. A spinal puncture gave a clear fluid containing only 10 cells. The spinal fluid pressure was 13 cm. of water. The patient left the hospital eighteen days after admission with her condition practically unchanged.

COMMENT

The thrombosis in the first case was unquestionably due to a contusion of the internal carotid artery. Although the true diagnosis was made before death our first impression was that the symptoms and physical signs were due to a "head injury."

The real nature of the damage to the artery, undoubtedly the internal carotid, is not so certain in the second case. The delayed onset of the hemiplegia for thirteen days, together with the negative roentgenological and spinal fluid studies would indicate that the bullet had caused a contusion or laceration which was later followed by an extensive thrombosis. The diagnosis was not so difficult in this case because of the obvious injury to a large artery.

In both cases the posttraumatic thrombosis of the internal carotid artery resulted in a delayed but complete contralateral hemiplegia.

REFERENCES

1. Varneuil, M. Bulletin Academy of Medicine—Paris Seance, (Jan. 16) 1872.
2. Makins, G. H. Gun Shot Injuries to Blood Vessels. Bristol, 1919.
3. DaCosta, J. C. Modern Surgery. Tenth Edition 1931. Philadelphia. Saunders.
4. Reid, Mont R. and Andrus, W. D. Article on Surgery of the Arteries. Nelson's Loose Leaf Surg. Vol. 1, p. 741–786–7.

CALCIFIED DEPOSITS IN SUBSCAPULARIS TENDON

REPORT OF A CASE

C. EDWARD THOMPSON, M.D. AND CHARLES W. MCLAUGHLIN, JR., M.D.

OMAHA, NEBRASKA

DURING the past twenty-five years much has been learned concerning the pathology of painful lesions of the shoulder joint. As a result of the work of Codman, Carnett, Brickner and others, it is now well recognized that calcified deposits in the several tendons inserting about the shoulder joint are a frequent cause of pain in this region.

The tendon of the supraspinatus muscle is much the most frequently involved and it is such a lesion that is erroneously called subdeltoid or subacromial bursitis. Calcified deposits in the tendons of the infraspinatus and the teres minor muscles are not infrequent, but the presence of such deposits in the tendon of the subscapularis muscle appear to be distinctly rare.

CASE REPORT

T. B., male, aged fifty years, was first seen on May 20, 1935, complaining of pain and tenderness about the right shoulder. His past history was essentially negative except for a minor injury to the same shoulder received twenty years before while playing soccer. The patient was a dry cleaner by trade and actively engaged in this work until the onset of the present illness.

Twenty-four hours before reporting for examination, the patient was thrown into a pulley, striking his right shoulder. He immediately noticed pain in the right shoulder with associated tenderness over the anterior portion of the joint, but he continued to work during the remainder of the day. The pain however became progressively more severe during the next twenty-four hours and any motion of the shoulder caused distress.

On examination the patient was a well developed, well nourished, stocky individual suffering marked pain in the right shoulder. The temperature was 101°F., the pulse 90 and the respirations 22. The right forearm was supported by the left hand and every effort was made to limit all motion in the right shoulder joint. Positive physical findings were limited to this region. There was no asymmetry, atrophy or deformity in the region of the joint. On gentle palpation exquisite tenderness was elicited over the lesser tuberosity of the humerus, extending down the inner edge of the bicipital groove for a short distance. There was no tenderness over the greater tuberosity and no increased heat or discoloration of the skin noted. Flexion and extension of the forearm caused no discomfort but rotation of the humerus was extremely painful. Abduction of the arm also caused marked pain and was limited to approximately 45°. A tentative diagnosis of fracture of the lesser tuberosity of the humerus was made, but the usual anteroposterior and lateral *x*-ray plates taken were negative for fracture. The patient's forearm was placed in a sling and he was sent home with instructions to rest and apply heat locally for a period of twenty-four hours. At the end of this time the patient's temperature was normal but the pain had increased in intensity. Tenderness was even more marked and any rotation of the shoulder was resented. He was admitted to the Immanuel Hospital for further *x*-ray studies and treatment.

On the assumption that this might be a bursitis or a calcified tendonitis in the region of the lesser tuberosity, *x*-ray studies were made with the arm slightly rotated and abducted 90° to obtain better visualization of the lesser tuberosity. The films taken in this position are shown in Figure 1 and the report submitted by Dr. Tyler is as follows: "*X*-ray examination of the patient's right shoulder taken with the arm in the abducted position shows a calcium deposit in the region of the lesser tuberosity, interpreted as being a calcified bursa."

A clinical diagnosis of calcified tendonitis involving the tendon of the subscapularis muscle was made and the patient was treated conservatively for a period of five days. There was no improvement during this time and operation was decided upon in an effort to

relieve the patient's pain and permit him to return to his work at an early date.

Operation, May 30, 1935. Under open drop ether anesthesia, using a modified Lane technique an incision 6 cms. in length was made over the anterolateral aspect of the patient's right shoulder, extending down from the acromial process. The deltoid muscle was split and the greater tuberosity exposed. The tendons of the supraspinatus, infraspinatus and teres minor muscles were each carefully examined and seen to be normal. Rotating the arm outward, the lesser tuberosity was exposed. A definite yellowish-gray deposit, 1 cm. in diameter, was seen in the substance of the subscapularis tendon. This area was incised and a quantity of thick granular material simulating toothpaste escaped. This pocket was then thoroughly curetted, no effort being made to close the rent in the tendon. Further exploration disclosed an extension of the process downward along the inner edge of the bicipital groove, beneath the short head of the biceps. In this area about 1 cm. of similar white pasty material was found and removed. A small fragment of the tendon of the subscapularis adjacent to the calcified deposit was removed for section and a culture was taken. The wound was closed in layers and the arm loosely bound to the side for a period of twenty-four hours.

Pathological Report. The material removed for culture was sterile. Microscopic examination of the tissue removed for section showed edematous connective tissue, in which there were large numbers of mononuclear cells and diffusely distributed polymorphonuclear cells.

Diagnosis. Acute and subacute inflammation.

Twenty-four hours after the operation the patient's pain was entirely relieved and he made a rapid and uneventful recovery. One week after operation he could abduct his arm 90° without pain and rotation was accomplished without the least discomfort. He returned to his work one month following operation and has continued without pain, weakness or limitation of motion in the six months that have elapsed since that time.

DISCUSSION

The tendon of the subscapularis muscle appears to be a very unusual site for the deposition of calcified deposits causing acute shoulder pain. In a careful review of the literature covering the past twenty years only 2 such cases have been found.



FIG. 1. Film of the upper right humerus with the arm in the abducted position. Note calcified deposit overlying the lesser tuberosity.

Both of these were reported by Codman in a personal series of 970 lesions of the shoulder joint, of which 135 patients suffered with calcified tendonitis.

That the tendon of the subscapularis should be involved much less frequently than the supraspinatus, infraspinatus and the teres minor is readily understood from an anatomical standpoint. However an adequate explanation for the development of the pathological process in our patient is as difficult to suggest as in the more frequent case in which the tendon of the supraspinatus is affected.

Acute and chronic trauma to the shoulder, occupation, working with the arms in the abducted position, focal infection and abnormal calcium metabolism have all been suggested as factors predisposing to the development of painful calcified tendonitis. Typists, file clerks, chauffeurs and physicians constitute more than a normal percentage of patients suffering from this condition. It seems quite logical to suspect that prolonged hours of work with the arms abducted, may place undue stress

upon the tendons about the shoulder joint and predispose to pathological changes. This patient has for years operated a pressing machine which necessitates working for hours with the arms abducted 90° from the body.

There can be little doubt that the calcified deposits were present in the involved tendon prior to the acute trauma which caused the patient to seek medical advise. The frequency with which painless calcium deposits about the shoulder joint are seen by the roentgenologist in the course of examinations for other causes, is good evidence that many of these lesions may go for years without causing any trouble. That varying degrees of trauma to such deposits may promptly result in acute symptoms is also well appreciated. This patient undoubtedly is an example of such a sequence of events.

Little difficulty is encountered in demonstrating on the *x*-ray plate calcified deposits present in the tendons inserting into the greater tuberosity of the humerus. However, when such collections occur in the subscapularis tendon, as in this case, they may be very easily overlooked in the usual anteroposterior and lateral views taken. If the deposit is recent, it may cast only a faint shadow on the film, and overlying the head of the humerus, be readily missed. Placing the film in such a position that the lesser tuberosity is seen in profile readily obviates the possibility of missing such a deposit, should it be present. One wonders if cases of pain about the shoulder joint due to calcification in the tendon of the subscapularis muscles are not infrequently undiagnosed when studied in the usual manner by *x*-ray.

Bed rest, morphine for pain, gradually carrying the arm into the abducted position by traction, heat or cold locally, injections of quinine and urea and diathermy have all been suggested in the conservative treatment of these lesions. Codman is the authority for the statement that, in his experience, all cases of calcified tendonitis, whether treated or not, eventually recover without any permanent complications of any kind. "Recovery is only a matter of time." One may in all honesty assure the patient that the calcified deposit will in all probability disappear spontaneously in a period of several months. Should the deposit chance to rupture into an adjacent bursa, permanent relief will probably follow in a few weeks time.

In most instances, however, the economic factor must be considered and many patients suffering from the acute pain incident to a calcified tendonitis are either unable or unwilling to devote the time necessary to treatment by conservative measures. To this group of individuals surgery may be offered as a prompt and safe way of relieving their pain and permitting their early return to work with little chance of recurrence.

SUMMARY

A case of acute shoulder pain incident to the presence of calcified deposits in the tendon of the subscapularis muscles is reported. Only 2 similar cases have been found in the literature covering the past twenty years. Surgical removal of the deposit resulted in the prompt relief of pain and complete return of function.

REFERENCES

1. Codman, E. A. On stiff and painful shoulders. *Boston Surg. and Med. Jour.*, 154: 613, 1906.
2. Codman, E. A. The Shoulder, Thomas Todd Co. Boston, 1934.
3. Carnett, J. B. Calcareous deposits of so-called calcifying subacromial bursitis. *Surg. Gynec. Obst.*, 41: 404, 1925.
4. Carnett, J. B. A clinical and pathological discussion of so-called subacromial bursitis. *Surg. Clin. No. America*, 9: 1107, 1929.
5. Carnett, J. B. So-called subacromial Bursitis. *Surgical Clinics of No. America*, 10: 1309, 1930.
6. Carnett, J. B. So-called subacromial bursitis. *Radiology*, 17: 505, 1931.
7. Brickner, Wm. Prevalent fallacies concerning subacromial bursitis. *Amer. Jour. Med. Sci.*, 149: 351, 1915.
8. Brickner, Wm. The location and cause of lime deposits associated with subacromial bursitis. *Amer. Jour. Surg.*, 30: 108, 1916.
9. Brickner, Wm. Pain in the arm—subdeltoid bursitis. *J. A. M. A.*, 69: 1237, 1917.

[*For Remainder of References see p. 537.*]

METASTATIC TUMORS OF HEART

J. K. MILLER, M.D.

Pathologist, State Sanatorium, Wallum Lake, R. I.

INGLESIDE, NEBRASKA

METASTASES of malignant tumors to the heart are somewhat more common than primary growths of this organ. Mead,[1] from the literature, found an incidence of 0.5 per cent in general autopsies and a frequency of 3.1 to 7.5 per cent amongst malignant necropsies. Practically any organ of the body in which a malignant growth may arise, may be the primary site from which metastases disseminate to the heart. Morris'[2] and Goldstein's[3] extensive reviews record cardiac colonies from tumors of the traches, tongue, breast, submaxillary glands, eye, nasal passages, thyroid,[4] eosophagus, stomach, pancreas, liver, kidney,[5] uterus, testis, labia, lungs,[6] lymph glands and skin.

Of those tumors metastasizing to the heart, bronchiogenic cancer is probably the most frequent offender. The continuity and contiguity of thoracic structures may account for this incidence. Again, the role played by the lungs in the cardiovascular cycle suggests another reasonable explanation. Adler,[7] in a series of 374 cases of pulmonary malignancy, found 39 cases with metastases to the pericardium of which 30 invaded the heart proper. Simpson's[8] group of 139 cases revealed 62 instances of pericardial involvement but none encroached on the heart itself. Kikuth[9] observed myocardial colonies in 4 of his 240 recorded cases. Miller and Jones,[10] summarizing 808 cases of primary pulmonary neoplasms, found metastases to the pericardium and heart in 2.7 per cent of the cases; Burke[11] lists 14 cases of secondary colonies in the heart, a frequency of 4.3 per cent, in 327 malignant necropsies.

Lymphatic conduction accounts for a limited number of metastases to the heart. Through the tracheobronchial glands which drain pleura, lungs, and contents of the pericardial sac a retrograde invasion may occur from the lung to the heart. Kapsinow[12] cites his case of carcinoma of the breast in which direct lymphatic infiltration to the heart could be traced.

Direct extension is possible, but Morris[2] states that the heart is seldom involved by direct continuity from neighboring organs and Mead's[1] summary of a large series substantiates this view.

Generally, cardiac metastases are believed to be blood borne. Fried[13] found tumor cells invariably present in the lumen and walls of blood vessels of every organ studied for its metastases. This constancy supports a premise of hematogenous dissemination. Tumor cells in the blood stream, mural and valvular thrombi of cancer cells, small bits of tumors in blood clots and strands of carcinomatous cells in the coronaries add further proof. It is commonly believed that the pulmonary veins act as a route over which the tumors cells are not only conveyed, but act as a road bed along which direct extension may occur.[1] In a like manner, the vena cava has served.[1,4,14] The great vessels to the heart form an important route of direct extension. Hematogenous dissemination infers the establishment of the secondary colonies within the heart chambers and their contents. Such is generally the case. However, small cellular emboli may escape such a fate, and instead finally lodge in the terminal branches of the coronaries, forming intramural tumors. Such infrequent[9] but possible colonization has prompted the report of the following observed case.

CLINICAL HISTORY

E. P., a white male dyer, forty-seven years old, was admitted January 14, 1935 complaining of fatiguibility, productive cough, dyspnea,

chills and fever and a weight loss of 18 pounds since the onset, November, 1934. Physical examination revealed emaciation, clubbing of fingers, dimunition of breath sounds throughout both lung fields, bronchial breathing and coarse rales in the right base and liver palpable 5 cm. below the costal margin. The cardiovascular system appeared within normal range.

On January 16 *x*-ray examination of the chest showed initially a diffuse mottling of the right lung field, followed by an atelectasis on January 29. A postmortem film taken February 3 showed an interlobar empyema between the right middle and lower lobes.

The sputum was persistently negative for acid fast organisms. The blood sedimentation rate was 45 mm. in the first hour and 57 in two hours, leucocytes 15,000 with 77 per cent neutrophiles.

The patient ran a septic temperature and expectorated from 90 to 130 grams a day.



Fig 1



Fig. 2.



Fig. 3.

Fig. 1. Heart showing metastatic nodules
Fig. 2. Lung showing central white area of tumor mass and the interlobal empyema.
Fig. 3. Kidney showing adrenal metastasis.

AUTOPSY FINDINGS

Lungs (Fig. 2). The right lung showed diffuse miliary abscesses of the upper and lower lobes, associated with a bronchiectasis. Between the middle and lower lobes was an empyema cavity of 75 to 100 c.c. capacity. On opening the right bronchus, the wall especially superiorly, was thickened 1.5 to 2 cm. The mass occurred just beyond the tracheal bifurcation and surrounded the primary branches of the bronchus. It was cartilagenous in consistency and grey in color. The border infiltrated indistinctly into the parenchyma. The left lung showed a moderate passive congestion.

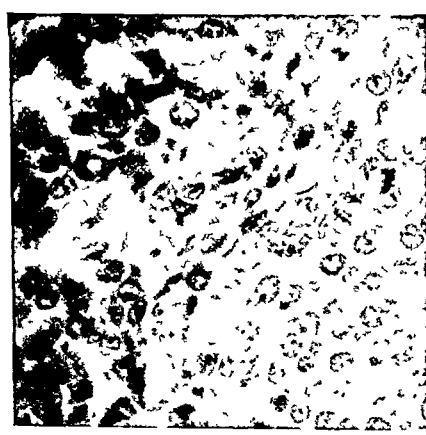


Fig. 4. High power of primary tumor in the lung.

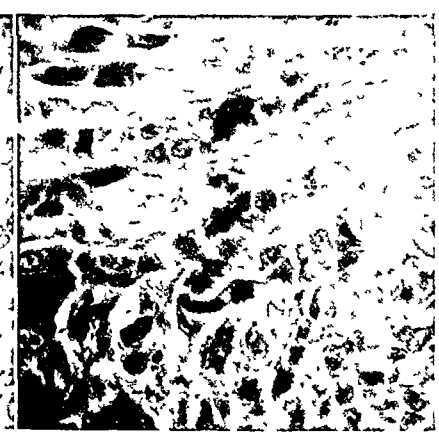


Fig. 5. High power of metastatic nodule in the heart.

Heart (Fig. 1). In the anterior portion of the right auricular wall was a small sharply demarcated grey nodule, 1 cm. in diameter, and the left auricular appendage presented a similar nodule. Two nodules, 3 mm. in diameter, were found in the wall of the left ventricle

just beneath the pericardium, anteriorly. No other tumor tissue was found in the heart or coronary vessels.

Secondary colonies were observed in the superior pole of the right kidney, the right adrenal and the mediastinal lymph nodes (Fig. 3).

Microscopic examination showed the primary tumor to be a bronchiogenic carcinoma, Epidermoid, Grade II, R.R. In places it showed considerable polymorphism and the metastatic lesions displayed a greater degree of anaplasia than the primary focus (Figs. 4 and 5). The myocardial colonies showed a complete ring of peripheral muscle fibers with an intact endocardium and pericardium, denying an invasion either from the pericardium or the heart chamber.

DISCUSSION

The interesting feature of this case lies in the secondary colonies in the heart. Their dissemination is obviously hematogenous. Since both the large vessels to the heart, the heart chambers, the pericardial sac and the coronary vessels were free of any tumor tissue, it is probable that the tumor cells circulating in the blood stream found their way into the terminal branches of the coronaries and lodged in the myocardium setting up metastases.

SUMMARY

A case of bronchiogenic carcinoma of the main bronchus is observed in which there were cardiac metastases whose isolated nature suggests dissemination by blood borne cellular emboli.

REFERENCES

1. Mead, C. H. Metastatic Carcinoma of the Heart Secondary to Primary Carcinoma of the Lung. *J. of Thoracic Surg.*, vol. 2: pp. 87–98, 1932–1933.
2. Morris, L. M. Metastases to the Heart from Malignant Tumors. *Am. Heart J.*, 3: p. 219, 1927–1928.
3. Goldstein, H. I. Tumors of the Heart. *New York M. J.*, 115: pp. 97–110; pp. 158–161, 1922.
4. Kaufmann, E. Pathology, Vol. 1, p. 84.
5. Dean, Archie, Jr. and McNattin, R. F. A Case of Renal Adenocarcinoma with Unusual Manifestations. *Am. J. of Cancer*, xv, No. 3, pp. 1570–1576, 1931.
6. Breus, B. Weiner Med. Woch, 1878, p. 28 (quoted by Kaufmann, E.).
7. Adler, I. Primary Malignant Growths of the Lungs and Bronchi, New York, 1912, Longsmans, Green and Co.
8. Simpson, S. L. Primary Carcinoma of the Lung. *Quart. J. Med.*, 22: p. 413, 1929.
9. Kikuth, W. Ueber Lungencarcinom. *Virch. Arch. f. path. Anat.*, 1925: 255, p. 107.
10. Miller, J. A. and Jones, O. S. Primary Carcinoma of the Lung. *Amer. Rev. of Tuberculosis*, xxi, p. 1, Jan., 1930.
11. Burke, A. M. Metastatic Tumors of the Heart. *Am. J. of Cancer*, 20: pp. 33–48, Jan., 1934.
12. Kapsinow, R. Cancer of the Heart. *Ann. Surg.*, 63: p. 161, 1926.
13. Fried, B. M. Primary Carcinoma of the Lung, Baltimore, 1932, Williams and Wilkins Co.
14. Culpepper, A. L. and von Haam, E. Primary Carcinoma of the Liver. *Am. J. of Cancer*, 21: pp. 355–362, June, 1934.

TRAUMATIC RHABDOMYOSARCOMA OF THIGH*

HERMAN CHARACHE, M.D.

Assistant Visiting Surgeon, Cumberland and Harbor Hospitals, Assistant Radiation Therapist, Brooklyn Cancer Institute

BROOKLYN, NEW YORK

RHABDOMYOSARCOMA is a lesion of very uncommon occurrence. Skeletal muscle involvement is extremely



FIG. 1. Cauliflower growth of rhabdomyosarcoma.

rare and very few authentic cases with autopsy findings are reported in the literature. Up to 1913 Burgess[1] did not find a single case recorded, when he reported a case of rhabdomyosarcoma of the thigh with multiple metastasis in a girl of nineteen years. Muller[2] in 1917 reported a case of traumatic rhabdomyosarcoma of the thigh following successive fractures of the femur. In 1927 Wagner[3] reported a case occurring in the buttock. A year later Wolbach[4] reported a case of malignant rhabdomyoma of the spinal muscles at the region of the fifth and sixth dorsal vertebras. In 1929 one case reported by Hirsch[5] occurred in the leg with metastasis to the lungs, and another case was reported by Jeanneney[6] occurring in the quadriceps muscle. Two cases were reported by Singleton and Hyde[7] in 1931, both occurring in the left thigh. MacCallum[8] reported 2 cases in 1932, one occurring in the arm with suggestive metastasis to the lungs and the other in the calf of the leg. This totals 10 cases reported since 1913.

In reviewing the literature of rhabdomyosarcoma of skeletal muscle, one is impressed by the numerous operations to

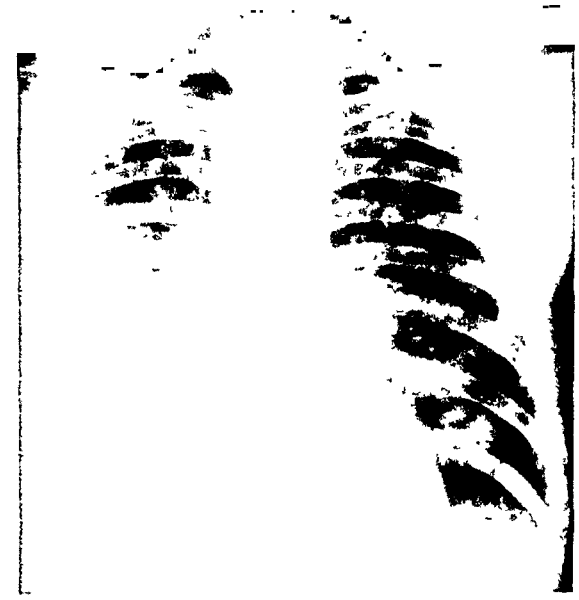


FIG. 2. Rhabdomyosarcoma metastasized to the lungs.

which each case was subjected, and the numerous recurrences, finally ending in amputation of the limb, followed by metastasis and death. The conservative multiple surgery instead of radical excision may perhaps be explained by the great confusion existing in reporting these tumors, and the difficulty encountered in recognizing them. This difficulty is well illustrated by MacCallum, who states, "Since the criterion frequently demanded before an origin from muscular tissue will be admitted is the demonstration of the characteristic cross striations, it is not at all improbable, indeed it is almost certain, that many tumours truly of such origin or character are not recognized as such, and are relegated to the tumour scrap-heap of sarcoma," therefore this "scrap-heap of

* From the Brooklyn Cancer Institute, Dr. Ira I. Kaplan, Director.

sarcoma" contains a multitude of tumors. Not only the lack of cross striations makes the origin of this type of tumor difficult, but the preponderance of spindle type of cells, round cells and the presence of fibroblasts, which makes it appear truly a fibrosarcoma. MacCallum concludes that mixed spindle and round cell sarcoma occurring in any tissue calls for critical examination if we are to mitigate the ignorance that induces us to seek refuge in such narcotic nomenclature.

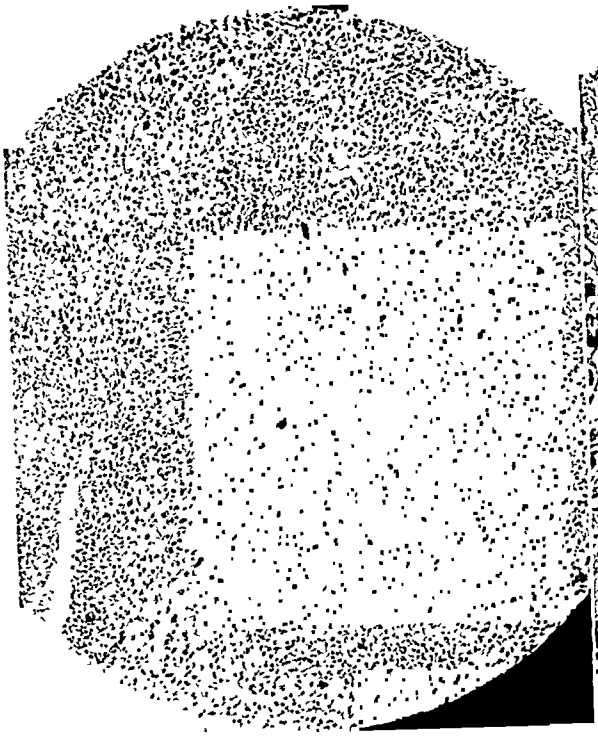


Fig. 3. Microphotograph under low power showing rhabdomyosarcoma of the thigh.

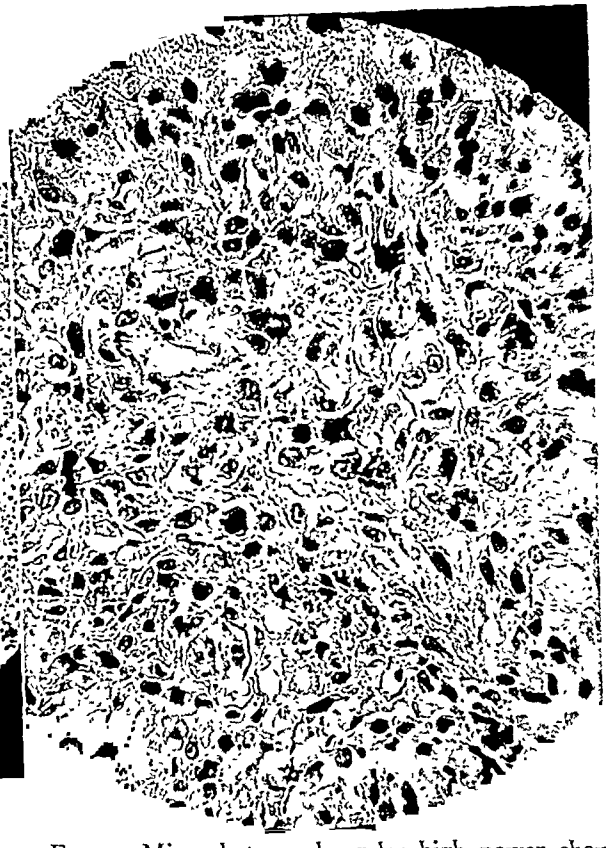


Fig. 4. Microphotograph under high power showing rhabdomyosarcoma of the thigh.

CASE REPORT

A white adult male, aged forty-four years, was admitted to the Brooklyn Cancer Institute on May 7, 1935, complaining of pain and swelling of the left thigh. About a year previously he had fallen and struck his left thigh, a week later a blue, nontender lump appeared at the site of the injury, which grew progressively larger until it reached the size of a grapefruit. About six months later the tumor became very painful, and he was admitted to a hospital, where the tumor was excised. However, the wound never healed and began to ulcerate. He received *x*-ray therapy without any improvement and was then referred to this institution for further advice and treatment.

As a child he had measles and scarlet fever. At the age of fourteen years he had malaria and shortly afterwards he contracted gonorrhea. There was no other history of disease. His family history was essentially negative.

Physical examination revealed a white adult male, poorly nourished, anemic, with a Hippocratic facies, weighing 134 pounds, 5 feet 8 inches in height, moaning with pain, temperature 102.8°F., pulse 118, respiration 22, blood pressure 102/60. The anterior aspect of the left thigh presented an ulcerated, necrotic cauliflower mass, which bled very easily upon manipulation, measuring 7 × 4 inches, with induration and swelling of the surrounding tissues. Glands were found in the left inguinal region, the size of a hazelnut, firm and freely movable. Examination of the chest revealed evidence of fluid in the right base with scattered areas of dullness and loss of breath sounds

bilaterally. The rest of the physical examination did not yield any pathologic findings.

The urine examination showed no abnormality. The blood Wassermann was negative. The blood count revealed 22,000 white cells with 89 per cent polymorphonuclears, 10 per cent lymphocytes and 1 per cent eosinophiles. The red count was 2,800,000 with hemoglobin of 55 per cent. Roentgen ray examination of the chest revealed an effusion in the right pleural cavity with numerous circumscribed metastatic foci throughout the right and left lung fields. Roentgenogram of the left femur did not show any bone pathology.

On May 22 a thoracocentesis was performed on the right chest and 1200 c.c. bloody fluid was removed. A radium pack was applied to the leg, consisting of six radon platinum tubes containing 256 m. c. radium emanations at 6 cm. distance. The patient received a total of 27,265 m. c. hours. However, he became progressively worse, his temperature rose to 105°F., he became very dyspneic, and he died May 26.

An autopsy was performed. The final diagnosis was reported by Dr. S. H. Polayes, pathologist, as:

1. Rhabdomyosarcoma of the left thigh with metastasis to the lungs, pleura, pericardium, liver, kidneys, and inguinal, tracheal and aortic lymph nodes, skin.
2. Serosanguineous pleural effusion.
3. Chronic purulent pericarditis.
4. Toxic splenitis.
5. Purulent bronchitis.
6. Bronchopneumonia.
7. Renal cloudy swelling and congestion.
8. Multiple visceral thromboses.

COMMENT

This case is of interest not only because of the rarity of the tumor, but also its association with direct trauma. Ewing[9] states that "Sarcoma commonly develops after a single blow." A history of trauma in similar tumors is reported by Muller in 1917 and Hirsch in 1929. Coley[10] reported 26 cases of traumatic soft tissue sarcoma in 1889. This is another case of definite *rhabdomyosarcoma occurring on the site* of a distinct trauma to the thigh.

REFERENCES

1. Burgess, A. M. *Jour. Med. Res.*, 29: 447, 1913.
2. Muller, H. R. *Jour. Cancer Res.*, 2: 393, 1917.
3. Wagner, J. H. *Atlantic Med. Jour.*, 31: 570, 1927.
4. Wolbach, S. B. *Arch. Path. and Lab. Med.*, 5: 775, 1928.
5. Hirsch, E. F. *Arch. Path. and Lab. Med.*, 8: 9, 1929.
6. Jeanneney, M. G. *Jour. de méd. de Bordeaux*, 106: 398, 1929.
7. Singleton, A. O. and Hyde, W. A. *Texas State Jour. Med.*, 26: 778, 1931.
8. MacCallum, P. *Aust. and New Zealand Jour. of Surg.*, 2: 296, 1932–1933.
9. Ewing, J. Neoplastic Diseases, 3rd Ed., Phila. Saunders Company, p. 117, 1928.
10. Coley, W. B. *Ann. Surg.*, 27: 259, 1898.

PERIPHERAL VASCULAR DISEASE WITH GANGRENE OF EXTREMITIES

CASE REPORT

R. J. DITTRICH, M.D.

Orthopedic Surgeon, Mercy Hospital

FORT SCOTT, KANSAS

THE following case is reported to show some interesting pathological features associated with peripheral vascular disease.

W. B., white female child, aged four and one-half years, was seen October 10, 1934, being referred for treatment of a gangrenous condition of the right foot and fingers of both hands. According to the history, the condition was first noticed at six to eight weeks of age. She used to bite the ends of her fingers, which apparently had no sensation. The ulcerated ends of the fingers refused to heal and gradually the trophic process involved most of the fingers of both hands. On one occasion, at the age of two years, she intentionally cut the skin of the palms and fingers of both hands with a razor, without feeling any pain. The skin of the extremities and face has always been very slow to heal, even with minor abrasions.

About a year ago she accidentally cut the big toe of her right foot by stepping on a piece of broken glass. Although the wound was trivial, a gangrenous process developed and gradually extending until it included the two phalanges of the big toe and the head of the first metatarsal bone, together with the soft tissues.

The patient's mother was living and well. Her father was living, but had had a positive Wassermann and had received antileutic treatment. The patient also had antiluetic treatment about two years previously.

Examination. In general appearance the patient showed a definite mental retardation and was moderately anemic. An interstitial keratitis was present in both eyes, more prominent on the right; the outline of the pupils could not be seen. Vision undoubtedly was present but in looking at close objects she would turn her head and look out of the corner of her eyes. Hearing was not impaired. She had an ulceration of the septum of her nose, involving the cartilaginous portion. Her tonsils were cryptic. She had a marked speech defect and was constantly drooling saliva.

The knee jerk was absent on the right. The right inguinal lymph nodes were moderately enlarged but not painful. The patient could walk without difficulty and coordination of movements was very little impaired. The right big toe was amputated at about the level of the metatarsophalangeal joint. At the site of the amputation was a gaping wound, whose margins were covered with a grayish necrotic tissue with very little bleeding on scraping the wound. There was no attempt at granulation tissue formation and the entire wound seemed avascular. The skin of the feet, legs and thighs showed a mottled bluish discoloration, which became more marked when the extremities were dependent and disappeared slowly on elevation. The pulse of the dorsalis pedis and posterior tibial arteries could not be palpated in either foot. The skin of the feet and legs was cold and moist with no sensation of pain evoked on pinching or on deep pressure. In the right leg and foot, the skin and subcutaneous tissues had a firm rubbery feel. Several ulcerated areas in the skin of the leg just below the knee resulted from small abrasions produced a number of weeks previously which spread subsequently and failed to heal (Fig. 1).

In the hands, the thumbs and most of the fingers had lost the terminal phalanges due to gangrene and the skin and subcutaneous tissues were swollen so that very little motion in the fingers was present. The skin of the ends of the fingers had a pale marble-like appearance. In the arm and forearm the skin had the same mottled appearance as the lower extremities, though less marked. No sensation of pain was elicited. As in the lower extremities, the skin of the hands, forearms and arms was abnormally cold and moist.

The skin of the face was pale, more uniform in color and sensation was definitely diminished.

Examination of the urine was negative.

Blood examination showed hemoglobin, 65 per cent; erythrocytes, 4,770,000; leucocytes, 14,950; differential, normal.



FIG. 1. Photograph showing condition of patient on admission.

The Kolmer and Kahn tests were negative.

The patient was admitted to the hospital on October 25, 1934. During a period of observation of one week, no change was noted in the patient's condition, in spite of attempts at local treatment. As a method of testing the circulation in the lower extremities, the patient was placed in a bathtub of water, immersing the feet, legs and thighs. In raising the temperature of the water, it was found that at 40°C., the skin of the lower extremities assumed a uniform pink color and at that stage sensation of the skin was definitely present.

From an analysis of the condition, it was obvious that a deficiency of the peripheral vessels was responsible for it. A vasospasm of the larger vessels, produced by overactivity of the sympathetic nervous system, was considered most probable as the underlying cause.

In deciding on the method of treatment which was instituted, the following points were considered: (1) the conception of Telford and Stopford[1] that vascular changes can be produced as a result of stimulation of the sympathetic nerves by mechanical influences; (2) the views of Oughterson, Harvey and Richter[2] that vasomotor innervation is supplemented by a source of nerve supply, other than that from the lower thoracic and upper lumbar nerves; and (3) the writer's belief in the possibility of abnormal structures such as occur in association with spina bifida occulta.[3] Success in the treatment was dependent on the presence of harmful influences within the spinal canal, and so arranged that injurious effects would be produced by irritation of the vasomotor nerves supplying the vessels of the lower extremities. The form of pathological change, which was considered most probable, consists of the presence of a mass of fat and fibrous tissue in close relationship to the nerve roots, with or without spinal clefts. It should be stated in this connection, that no spinal defects were found on *x*-ray examination of the lumbosacral and the cervicodorsal regions.

On November 2, 1934, the following operation was performed; under avertin-ether anesthesia, a midline incision was made over the lumbosacral region, reflecting the muscles to expose the upper portion of the sacrum. No bony abnormalities were found. The spinous processes, together with a portion of the lamina were removed from the first and second sacral segments. The dural sac was seen to pulsate normally at the level of the first sacral segment. The lower end of the dural sac, which was situated at the junction of the first and second sacral segments, was completely enveloped by a mass of grayish tissue which had the appearance of being mostly fat and had no visible connection with any of the bony structures of the canal. It occupied the level of the second and part of the first sacral segments and was not compressed by the bony canal. In attempting to remove it with instruments, it was found to be very friable. Several of the larger nerve roots were seen to be coursing through this mass of tissue, being completely enveloped by it at that level. At this stage of the operation, and before dissection could be completed, the patient's respiration ceased. After being revived, it was considered advisable to discontinue the dissection and the wound was closed.

A small particle of the tissue was examined by Dr. C. A. Hellwig, who reported as follows: On microscopic examination the tissue consists of fat and fibrous tissue which show

[1] TELFORD, E. D. and STOPFORD, J. S. B. *Brit. J. Surg.*, 18: 557, 1931.

[2] OUGHTERSON, A. W., HARVEY, S. C. and RICHTER, H. G. Observations on sympathetic vasomotor pathways. *Ann. Surg.*, 744 (Oct.) 1932.

[3] DITTRICH, R. J. Lumbosacral spina bifida occulta, *Surg., Gynec. and Obst.*, 53: 378, 1931.

infiltration with leucocytes and extensive hemorrhage (Fig. 2).

Recovery from the operation was favorable. The patient had involuntary urination and defecation for a period of ten days. The wound healed by primary union.



Fig. 2. Photomicrograph of tissue obtained from sacral spinal canal.



Fig. 3. Photomicrograph of tissue obtained from spinal canal at cervicodorsal level.

Immediately following operation a change was noted in the circulatory condition of the lower extremities. The skin had assumed a normal pink color and was warm and dry, ulcerations in the skin bled easily and freely. Although these changes were for the first few days attributed to the general reaction following operation, further observation showed them to be more permanent. Ten days after operation, several ulcerated areas which were present on the right leg for a number of weeks, had healed. Four weeks after operation, the gangrenous area at the site of the right big toe, was completely healed. During that time several small sequestra were extruded from the wound. Seven weeks after operation, the fingers were practically healed due apparently to local treatment. There was also a diminution of the swelling of the fingers, allowing better function.

The patient was dismissed from the hospital on December 18, 1934 and returned three weeks later. While at home, there was a recurrence of the gangrenous process of the fingers, partly as the result of a slight burn. The hands and fingers were pale, indurated and deficient in circulation, as seen from the refusal of tissues to heal normally and from the absence of normal bleeding. The lower extremities had retained a normal appearance in color and temperature.

Kolmer and Kahn tests at this time were again negative.

It was considered quite probable from these observations, that a pathological lesion, similar to that found in the sacral spinal canal was present at a higher level, to produce the disturbance in the upper extremities. With this type of condition in mind, an operation was undertaken on January 25, 1935. An incision was made over the spinous processes from the sixth cervical to the third dorsal vertebra, reflecting the muscles. The spinous processes and portions of the lamina of the seventh cervical and first and second dorsal vertebra were removed. The dura was found to be covered with a thin layer of soft reddish gray, very friable tissue, loosely attached to the dura. This tissue could be stripped off easily and was very vascular. The layer of tissue, evidently fat

and fibrous tissue, did not seem to extend ventrally but covered only the dorsal half of the dural sac. It was not under pressure from the bony canal. In thickness it varied from 1 to 3 mm. It covered the dura at the level of the first and second dorsal segments and possibly extended distally farther than the level explored. In removing this mass considerable diffuse hemorrhage was encountered but this was easily controlled. The muscle, fascia and skin were sutured in layers.

The pathological findings were reported by Dr. C. A. Hellwig as follows: "Grossly the specimens consist of fat and fibrous tissue, and several areas are hemorrhagic. Microscopically, most of the specimen consists of fatty tissue which is invaded by fibrous strands. The blood vessels do not show pathological changes. There is no proliferation of the intima. In one area a well formed piece of hyaline cartilage is found, in other areas a few deposits of amorphous lime material are noticed. Fresh hemorrhages are present in large areas."

Recovery from the operation was favorable. A superficial necrosis of a portion of the incision developed but this healed promptly. The upper extremities assumed a normal appearance in color and temperature. The condition of the fingers improved so that in four weeks all ulcerations had disappeared. At that time she was discharged from the hospital.

The patient was seen at intervals and had remained free from any of the previous disturbances for approximately six months.

When she was seen on July 21, 1935, she had just recovered from a short but severe attack of whooping cough. About a week previously the left index finger again became ulcerated, and there was also a recurrence of the gangrenous process of the right big toe. There was at this time a definite improvement of the condition of her eyes.

On examination December 7, 1935, a mild recurrence of the discoloration was seen in the lower extremities. The skin was warm and dry. The wound at the site of the amputation of the big toe was still open. On *x*-ray examination of the right foot it was found that the upper half of the first metatarsal was present and the lower end of this bone was necrotic. The pulse of the dorsalis pedis artery could not be palpated in either foot. The pulse of the posterior tibial artery was palpable in both feet. The interstitial keratitis previously seen in the left eye had entirely disappeared, and in the right eye it was diminished in size. The pupils were clearly visible in each eye and responded to light and accommodation. The hands showed several open wounds which were situated in the creases of the fingers.

On February 7, 1936, the gangrenous area of the right foot was again healed. The skin of the lower extremities was warm, dry, bright pink in color and had very much a normal appearance. An abrasion of the right leg, caused by an injury, showed evidence of rapid healing. The skin of the arms and forearms was normal in appearance. The hands and fingers showed no ulcerations. A mild return of the keratitis was noted in the left eye. The skin of the face in its reaction to injury, indicated a normal circulation.

COMMENT

In reviewing this case, the outstanding features are the pathological operative findings and the improvement which followed the operative treatment. The masses of fat and fibrous tissue are structures which have been described by numerous writers and are thought to be associated with spina bifida occulta. The most reasonable explanation for the occurrence of such masses is that of von Recklinghausen, who states that they are the result of a transposition of tissue during early embryonic life.

The improvement manifested by the rapid healing of the wounds in the leg and foot and by a more normal circulation, is attributed to the operation which, though incomplete, relieved the pressure on the nerves at that level. In the sacral region the abnormal tissue mass consisted mostly of fibrous tissue, with only small amounts of fat. There was evidence of inflammation and hemorrhage, and it is very likely that the soft tissue lesion was the site of a progressive change from fat to fibrous tissue. This would be expected to produce a gradual strangulation of the affected nerves.

In the cervicodorsal region the relationship of the pathological findings to the circulatory disturbance of the hands and face was not so clear. The mass of tissue

covering the dura was not seen to be in any direct contact with the nerve roots, nor was it possible to ascribe to it any pressure produced on the cord. The post-operative improvement in the condition of the upper extremities, though not as prompt as it was in the lower extremities, was such that it may be safely considered the result of removing a disturbing factor by the operation. The same factor was undoubtedly also responsible for the trophic disturbance of the face. The sympathetic nerves from the upper dorsal level of the cord constitute the only structure which has common connections with both of these regions. Therefore it seems likely that an irritation of the sympathetic nerves was responsible for the vasomotor dysfunction of the upper extremities and the face.

In conclusion it is obvious, from observations in this case, that the vasomotor disturbance can be ascribed to clear cut pathological structures, which can be removed by operation. The result was sufficiently satisfactory to justify further application of the therapeutic principles which were employed.

SUMMARY

The condition described in this case is evidently a vasospastic disturbance of the peripheral circulation. The treatment employed consisted of laminectomies in the lumbosacral and the cervicodorsal regions and the removal at both levels, of masses of fat and fibrous tissue, situated in the spinal canal. The immediate result of the operations was an improvement in the circulatory condition of the extremities, with a rapid healing of the gangrenous areas. With the exception of a brief recurrence of the vascular dysfunction, the result at the end of one year is very satisfactory.

REFERENCES OF DRS. THOMPSON AND McLAUGHLIN*

10. Dunlop, J. Deposit in the supra-spinatis muscle. *Am. Jour. Orthop. Surg.*, 14: 102, 1916.
11. Montgomery, A. H. Subdeltoid bursitis associated with deposition of lime salts. *J. A. M. A.*, 66: 264, 1916.
12. Smith, M. K. Subdeltoid bursitis with lime salt deposit. *Medical Record*, 91: 406, 1917.
13. Day, J. F. Observations on disabled shoulders with reference to subacromial bursitis. *Boston Med. and Surg. Jour.*, 178: 389, 1918.
14. Wolf, H. F. Acute subacromial and subdeltoid bursitis. *Am. Jour. Surg.*, 37: 59, 1923.
15. Hodges, F. M. Subdeltoid bursitis. *Virginia Med. Monthly*, 52: 155, 1925.
16. Granger, F. B. Calcified subdeltoid bursitis. *International Clinics*, 4: 265 (Dec.) 1926.
17. Simon, S. Concerning the mucous pocket formation in the shoulder joint of man. *Ztschrft. f. Anat.*, 81: 389, 1926.
18. Haussling, F. R. Painful shoulders. *Surg. Clin. No. America*, 6: 1503, 1926.
19. Morris, J. N. Disabilities of the shoulder region. *Med. Jour. of Australia*, 1: 432, 1926.
20. Fisher, C. F. Subdeltoid bursitis. *West Virginia Med. Jour.*, 23: 250, 1927.
21. King, J. M. Jr. and Homes, G. W. The diagnosis and treatment of 450 painful shoulders. *J. A. M. A.*, 89: 1956, 1927.
22. Bockoven, S. Inflammatory involvement of the bursae about the shoulder joint. *U. S. Vet. Bureau. Med. Bull.*, 6: 549, 1930.
23. Gillies, A. Shoulder pain—a consideration of some easily overlooked causes. *Canadian Med. Ass. Jour.*, 23: 402, 1930.
24. Cleveland, M. Shoulder pain. *Am. Jour. Surg.*, 8: 783, 1930.
25. Mumford, E. B. and Martin, F. J. Calcified Deposits in Subdeltoid Bursitis. *J. A. M. A.*, 97: 690, 1931.
26. Richards, T. K. A New Treatment of Acute Bursitis. *New England Jour. of Med.*, 205: 812, 1931.
27. Hitzrote, I. M. Surgical diseases of the shoulder bursae. *Ann. Surg.*, 98: 273, 1933.
28. Rodgers, M. H. Study of 100 Cases of Subdeltoid Bursitis. *Jour. Bone and Joint Surg.*, 16: 145, 1934.

* *Continued from p. 526.*

ACUTE EDEMA OF VULVA

DONALD J. THORP, M.D., AND C. P. WANGEMAN, M.D.

SEATTLE, WASH.

EDEMA of the vulva is not uncommon as part of a generalized edema associated with the late toxemia of pregnancy. However, an acute and selective swelling of the vulva in the absence of any marked peripheral edema is unusual. Its noteworthiness is evidenced by (1) the fact that in over 4000 full term pregnancies in the King County Hospital only 2 cases have been noted; and (2) the fact that there was a marked divergence of opinion as to the best manner of treatment of the condition, since it pointed to a very possible complication of labor.

Reports of this condition are relatively scarce in the medical literature, during the past twenty years approximately 15 cases being recorded. Hoehne, in Germany, discussed 5 cases about ten years ago, while Schmid considered it from the standpoint of an indication for caesarian section. Greenhill and Gertler, both writing in Germany, discussed the possible indications for caesarian section in edema of the vulva. Williams, in the American literature, presents an excellent illustration of a woman with unilateral edema of the labium.

Aside from its collaborative evidence as to the presence of a toxemia, acute edema of the vulva has no special significance. Dystocia is not likely despite the turgescence of the parts. Definite reduction of the swelling in the tissues is imperative, however, in obviating the possibility of laceration and hemorrhage.

Drainage of the fluid by either aspiration or stab wound at the most dependent portion of the labium is sufficient to eliminate the remote possibility of dystocia and the real danger of serious laceration. Drainage of vulvar edema seems to produce a favorable effect upon cervical edema should it be present, particularly if contractions are regular and strong but intervention is best postponed until preparations are completed for termination of the second stage of labor.

The etiologic background of such a selective edema is obscure. One of the 2 cases reported presented the classic pre-eclamptic syndrome, while the other case was associated with mitral stenosis and cardiac decompensation but revealed no symptom complex of toxemia. Obviously the increased cell permeability characteristic of the late toxemias of pregnancy contributes its share toward the appearance of such a local condition. The real local selectivity may be attributed to the normal increased congestion of the pelvic structures during pregnancy. Passive congestion of the pelvic organs is recognized as occurring in pregnancy where cardiac disease of decompensatory degree is associated.

CASE REPORTS

CASE 1. Mrs. E. V., age twenty years primipara, gravida ii, was hospitalized on June 13, 1934, for management of pregnancy at term complicated by an acute edema of the labia majora and minora. Her sole complaint on admission was a sensation of painful stretching in the external genitalia. She was not in labor.

The patient's history was negative except for an uncomplicated appendectomy in childhood and a normal pregnancy and delivery in 1932.

Her present illness began in April, 1934 with a gradual slight swelling of the ankles. She asserted that during April and May she gained fifty pounds in weight and occasionally noted headache, dizziness, diplopia and photophobia. According to a physician consulted during this period there was no albuminuria. On June 10, however, albuminuria appeared and she observed a sudden swelling of the labia.

On admission to the hospital three days later, the patient presented no evidence of acute illness. She was well nourished and



Fig. 1. Case I.



Fig. 2. Case II.

Figs. 1 and 2. Acute edema of vulva.

without marked generalized edema. General examination demonstrated a full term pregnancy with the occiput presenting and engaged. There was no edema of the abdominal wall, nor any ascites. Rectal examination revealed a short, soft cervix with 2 cm. dilatation.

The blood pressure was 170/105, the pulse 108; temperature 99.2°F. and respirations 20. The urine showed an alkaline reaction, specific gravity 1.021, albumin 21 per cent by volume, no sugar and microscopically a moderate number of hyaline casts and an occasional pus cell.

Conservative treatment was instituted for the toxemia. On the second hospital day the patient's blood pressure had increased to 180/120, the urine remained the same but the labial edema was much increased.

Induction of labor with castor oil and quinine was instituted on the second morning. Seventeen hours later mild labor pains were noted and three hours and fifty minutes after her first contraction a male infant weighing six pounds, seven and one-half ounces, was delivered spontaneously. The accompanying photograph was taken about one hour prior to delivery. (Fig. 1.)

During the course of delivery there was a slight mucous tear in each labia minora through which the fluid drained rapidly from both labia majora and minora. As no other laceration was present no repair was necessary. The third stage was terminated spontaneously and promptly. Upon return to bed the patient's condition was comparatively satisfactory though her blood pressure was 170/120.

Her discharge from the hospital was on the eighth postpartum day after an uneventful puerperium, her blood pressure was 120/90, there was no dependent edema, the urine had cleared satisfactorily and the labia were entirely normal.

Case II. Mrs. M. T., age twenty years, primipara, gravida 1, entered the hospital on June 28, 1934 complaining of an uncomfortable swelling of the external genitalia. No other distressing symptoms were noted except dyspnea which she had suffered for two years.

The vulvar swelling appeared abruptly one morning about two weeks prior to admission and became progressively worse in spite of rest in bed at home and limitation of fluids. Three weeks before hospitalization the patient's ankles began to swell slightly. No headaches, dizziness or occular symptoms had been experienced.

In the past history nothing pertinent to the present illness was found. Two years previously she had had pneumonia. Since then the dyspnea and a non-productive cough had made their appearance.

Examination of this patient revealed a pale, well nourished female with abdomen enlarged to slightly above the umbilicus. Moderate

dyspnea was present as she lay in bed. Respirations were 30; the pulse was regular and rapid; the blood pressure was 150/90; the temperature was normal. There were moist rales at the base of both lungs, the heart was enlarged and revealed definite mitral stenosis.

A very moderate pitting edema limited to the ankles was noted. The photograph (Fig. 2) is misleading on this point due to distortion from the proximity of the feet and the camera. Massive edema of the labia minora was present, but relatively little swelling of the labia majora accompanied this. Both labia minora were approximately 8 × 10 × 12 cm. This edema was not as marked as in Case 1, but the patient was obviously quite uncomfortable both at rest and during movement of the legs.

Laboratory analysis revealed no significant disturbances of the renal function.

This patient was placed on restricted fluids and routine antepartum care, while her cardiac condition was managed by the internist. The day following her admission spontaneous labor began and progressed. When the cervix was fully dilated she was prepared for delivery. Each labium minora was aspirated with a short, large bore needle and 450 c.c. of clear fluid obtained. Spontaneous delivery of a premature, though well developed, infant followed.

The postpartum course was uneventful and the patient was later transferred to the medical service for further treatment of her cardiac condition.

CONCLUSIONS

Two cases of acute vulvar edema are presented in pregnant women at term

The condition is unusual and its management may therefore easily perplex the average practitioner when confronted with such an edema.

Laceration and consequent serious hemorrhage may arise if timely reduction of the swelling is not planned.

Etiological factors in such a selective edema are obscure.

Proper management consists of aspiration or puncture during the second stage of labor with strict regard for asepsis.

REFERENCES

VILLARAMA, A. Edema of the vulva in labor. *Jour. Phil. Isle M. A.*, 2: (Mar.-Apr.) 1922.

WEISSENBERG, S. Treatment of edema of the vulva in labor. *Deutsch. Med. Wchnschrft.*, 51: (July 3) 1925.

HOEHNE, O. Treatment of grave edema of the vulva. *Deutsch. Med. Wchnschrft.*, 51: (Jan. 9) 1925.

GERTLER, H. Caesarian section in edema of the vulva. *Zentralblatt f. Gynaek.*, 50: (Feb. 13) 1926.

SCHMID, H. H. Marked edema as indications for Caesarian section. *Zentralblatt f. Gynak.*, 53: (Aug. 24) 1929.

NEW INSTRUMENTS

POSTOPERATIVE BACKACHE*

CAUSE AND MANAGEMENT BY IMPROVED HOSPITAL BED

J. K. BERMAN, M.D. F.A.C.S.

Assistant Professor of Surgery, Indiana University School of Medicine

INDIANAPOLIS

ANY device or measure which minimizes discomfort or adds to the well being of a patient may be said to be a useful part of the care, if not the cure of that individual. One of the most common and distressing complaints of postoperative patients is backache, therefore a consideration of its probable cause and control is timely. The symptom is not limited to surgical patients alone; anyone confined to bed may develop this annoying complication.

BRIEF HISTORY

Before the advent of the modern hospital in the preaseptic days, the surgeon was too engrossed in fighting "hospital gangrene," suppurating wounds and other matters of life and death to worry about the refined comforts of his patients. Then came Pasteur, followed by Lister who applied the Frenchman's discovery and inaugurated antiseptic surgery, and finally the evolvement of our present aseptic methods. With the latter came improvements and an ever widening field not only in the sphere of surgery but in the environment of the surgeon and his patient. Larger hospitals with excellent equipment were constructed and modern methods of caring for the sick were inaugurated. Even the hospital bed was not neglected in this progress. First, the change from wood to metal beds, then the change from circular coil springs to straight link springs which were easier to keep clean and much more uniform, and finally in 1909 Gatch[1] called attention to the necessity for head and knee rests in bed construction, a feature now almost universally employed in hospital bed manufacture.

THE PROBLEM

Patients who have been operated upon under general anesthesia complain of backache soon after consciousness returns and it usually persists for about three days. Da Costa[2] clearly describes it as "a cause of wakefulness aggravated by turning or twisting and by attempting to rise up from the bed. Pain is located in the lumbar and sacral region and is often accompanied by rigidity of the lumbar muscles." Dunlop[3] stated that "The patient during operation lay upon a flat table without support to the lumbar curve, consequently the sacro-iliac synchodroses were strained. The backache may be largely prevented by placing a small pillow so that it will support the lumbar curve during anesthesia."

ANATOMY

The majority of bedfast patients complain of backache which is referred to the lumbar region, the five movable true vertebra which normally form a curve

[1] GATCH, WILLIS D. The Sitting Posture; its postoperative and other uses. *Annals Surg.*, 49: 410 (Jan.–June) 1909.

[2] DA COSTA, J. CHALMERS. Modern Surgery. Ninth Edition.

[3] DUNLOP, JOHN. New York Med. Journal (July 10) 1909.

* From the Department of Surgery, Indiana University School of Medicine.

whose convexity is anterior or lordotic. According to Cunningham[4] there are four curves which, subject to some variation are seen in the vertebral column as a whole,

with the column erect and the head so placed that the axis of vision is directed towards the horizon. There is a forward curve in the cervical region, which gradually merges with the backward thoracic curve; this becomes continuous below with an anterior convexity in the lumbar region, which ends more or less abruptly at the union of the fifth lumbar with the first sacral vertebra where the sacrum slopes suddenly backwards causing the column to form a marked projection—the sacro-vertebral angle. Below this, the anterior concavity of the front of the sacrum is directed downwards as well as forwards. Of these four curves two—the thoracic and sacral are primary, they alone exist during fetal life; whilst the cervical and lumbar forward curves only make their appearance after birth—the former being associated with the extension and elevation of the head, whilst the latter is developed in connection with the use of the hind limb in the hyperextended position, which in man is correlated with the assumption of the erect posture—this curve therefore only appears after the child has begun to walk. For these reasons the cervical and lumbar curves are described as secondary and compensatory.

Since they are compensatory they will naturally vary with each individual, depending on his anatomical type. With this in mind and following Dunlop's suggestion, we placed a small pillow under the lumbar curve while the patient was on the operating table. This procedure did not lessen materially, if at all the incidence of backache. Perhaps the pillow is too yielding to give adequate support.

THE CAUSE

A side view of a patient lying in bed will show that in spite of spring improvement, there is a tendency to sag in the center much like a hammock. This leaves the lumbar curve without support or in a state of "hyperflexion" with its consequent strain on the lumbar muscles, (Diagram F) and rigidity or spasm soon ensues producing pain. No doubt this does not account for all postoperative backache. Some patients have backache before surgery which may be due to trauma to the vertebra or soft parts, referred pain from the pelvis, diseases of the vertebra or pelvic bones, new growths of the spinal cord, etc. Others develop backache postoperatively due to infection, as myositis or fibrositis of the lumbosacral muscles or arthritis of the spine or pelvis. However, the most common cause is acute muscle strain.

THE REMEDY

Physicians and patients alike know the value of lying on a "hard bed" when suffering from backache. Every experienced nurse has learned the simple remedy of placing a pillow under the lumbar curve to support it. Obviously the first consideration in the treatment is correct diagnosis for it would be futile to attempt the treatment of backache, due to rectal carcinoma or spinal cord tumor, by support. However, in that broad group of backaches referred to as traumatic or those due to infections of muscles, as myositis or fibrositis, rest through the medium of proper support is desirable and usually curative. Furthermore, it may prevent an untreated innocent muscle strain backache from becoming a more or less permanent symptom hard to explain and equally difficult to cure.

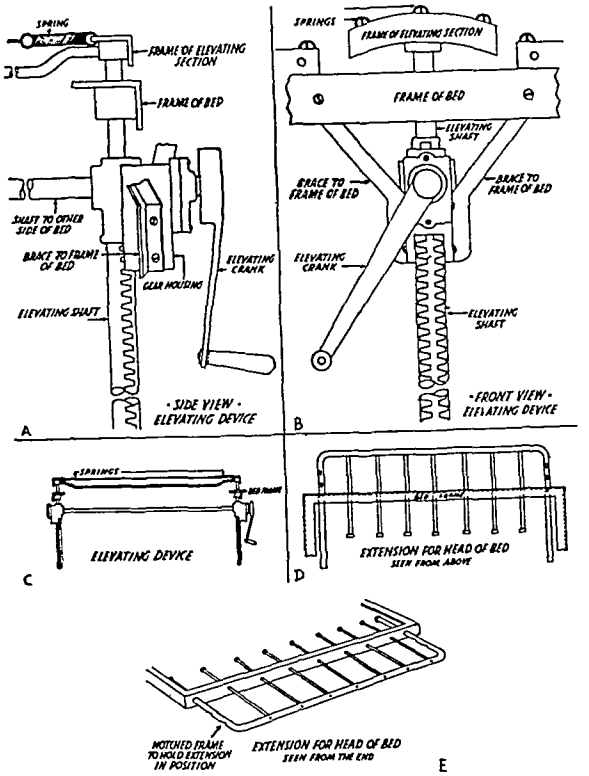
PREVENTION AND CURE

Jepson[5] has shown the advantage of hyperextension in traumatic backache. A blanket roll under the mattress, the Goldthwaite, Cleary, Granberry, and Cole hyperextension frames, the Whitman frame and the plaster cast method of maintaining hyperextension are useful present day modes of treatment. Our method of treating postoperative backache is also by lumbar support or hyperextension if necessary. However, it is obtained by a movable semicircular spring unit incorporated in our regular ward bed, which is lowered or elevated depending on the concavity of the lumbar curve of the patient, by turning the elevating crank (Diagrams A, B and C). The inclusion of this unit necessitated

[4] Cunningham. Text Book of Anatomy. Fourth Edition.

[5] Jepson, Paul N. Traumatic Backache. *Jour. Am. Med. Assn.*, Vol. 101: 1778 (Dec. 2) 1933.

shortening the back rest; therefore, a notched frame was installed, which may be pulled out when necessary for linear type



A, B AND C. illustrates mechanism of lumbar support elevating device; D and E. head rest extension to be used when back rest is elevated and not sufficiently long to meet patient's needs.

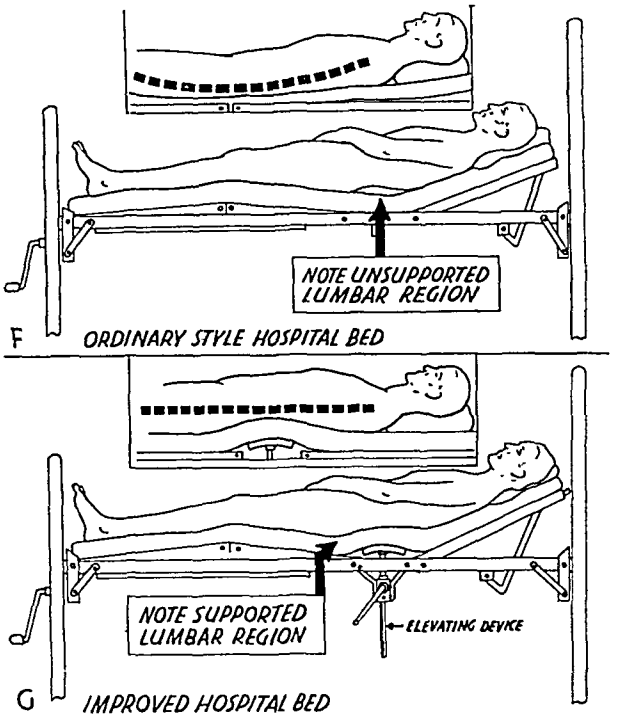
patients (Diagrams D and E). The lumbar support was found valuable even with the back rest elevated (Diagram G).

RESULTS

This bed has been in use in the Robert W. Long Hospital for about a year. All patients who have been put upon it thus far have not complained of backache. One woman with a sacroiliac strain, sustained prior to her cholecystectomy was placed in this bed after surgery. Her pain continued until forty-eight hours later when she shifted her sacrum directly on the lumbar unit and then she was relieved, stating that it gave her support. It is necessary that the patient is correctly placed on the support which should be properly elevated or obviously it will do no good.

DISCUSSION

This bed is not advocated as a panacea for all backaches regardless of the cause; we are simply suggesting that this new addition to the hospital beds will be a distinct improvement and will in an easy yet effective manner relieve the backache



F. illustrates "lumbar sag" in ordinary hospital bed; G. illustrates lumbar support in the improved hospital bed.

due to the causes described. This will make for a smoother convalescence and will add greatly to the comfort of patients. Furthermore, it may prove useful for a back support when needed in other types of backache than those specified.

CONCLUSION

1. The cause of most postoperative backaches is a sagging of the hospital bed producing "hyperflexion" of the lumbar curve and consequently straining the lumbosacral muscles.

2. To prevent this muscle strain, lumbar support is indicated.

3. This is easily obtained by our new addition to the hospital bed which is described.

4. These units may be easily incorporated in the routine manufacture of hospital beds and operating tables.

5. The curvative value of such a bed for other types of bachache is suggested.

The author wishes to express his thanks to Miss Elyzabeth Candy, R.N. for her helpful cooperation, and to Mr. Henry Peters for his aid in the construction of the "lumbar unit."

FASCIAL SUTURE CLAMP

HALL G. HOLDER, M.D.

SAN DIEGO, CALIFORNIA

THE use of fascial sutures in reconstructive operative procedures is well established. Its many applications in

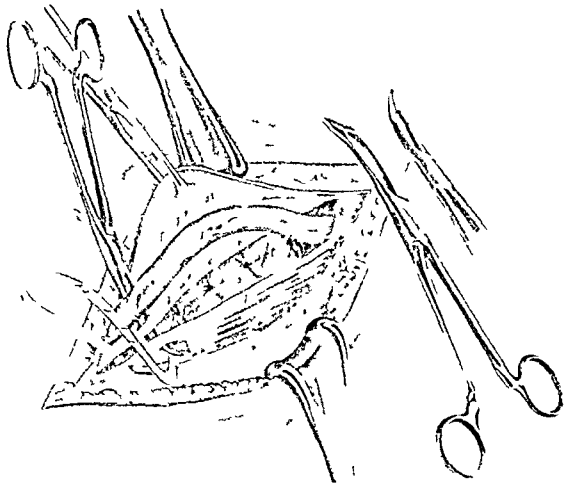


FIG. 1.

nearly every field of surgery needs no enumeration.

The use of a regular Galli needle, or other modifications, all present the same objections, i.e. marked traumatization of structures through which the needle must pass. The Galli needle for example, is broad in construction to cut a pathway for the aftercoming suture but this rent is further expanded by the necessity of sewing the fascial suture in the eye of the needle thereby creating a mass of tissue at this point. In suturing frail or attenuated structures the needle and sewn-in suture thereby often traumatize tissues to the extent that much of the strength and benefit of the fascial repair is lost.

The accompanying drawing illustrates the use of the suture clamp in a McArthur hernioplasty and an anterior and posterior view of the instrument is appended. It may be easily constructed from any curved hemostat by removing the rachet catch at the handle, flattening and sharpening the point to the desired degree and hollowing the proximal portion of the clamp surface. The latter is necessary to prevent catching adjacent tissue when the fascial suture is grasped by the point. Obviously the best method of use is to perforate the structures desired feeding the suture into the clamp and pulling it through, fixing it with a chromic catgut suture or steadying it with an Allis clamp until the next suture is placed.

I believe this suture clamp permits of more accurate placement of fascial sutures, quicker use and much less traumatization than the Galli needle.



[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

SPONTANEOUS VERSION AT TERM*

PALMER FINDLEY, M.D., F.A.C.S.

OMAHA

OSLER, quoting Fuller, tells us: "Old actions return again furbished over with some new and different circumstances." In conformity with this sentiment and recalling a spontaneous version near term occurring under my own observation, let us turn back the pages of history bearing in mind that "history deals largely with omissions." Thus in surveying the past we gain a better perspective of the present which is another way of saying that we see far when we stand on the shoulders of our ancestors.

Searching for the earliest records of man's conception of the normal presentation of the fetus in utero, we are carried back 4000 years before the Christian era and there we find the Chinese midwife instructing the expectant mother, at the onset of labor to walk about the room to facilitate the turning of the baby from breech to head.

From the historian Neuburger we learn of the ancient Hindus who believed that at the time of labor the fetus lay in the womb with the "head up, the hands folded across the forehead, lying on the right side of the mother if of the male, on the left side if of the female sex; before birth version occurs." At the onset of labor the child by its own volition, turned to a head presentation. In the fifth century of the Christian Era, Susruta, the Esculapius of Hindu medicine, taught that the turning of the baby from breech to head was due to the action of the air in the womb. The statement that a baby born in the seventh month has a better chance to live than if born in the eighth month is generally credited to Hippocrates but is clearly traced to the writings of the ancient Hindus. Thus we are reminded of the great antiquity of the theory of voluntary turning.

Hippocrates likened the position of the baby in the womb to a cork or olive in a long necked bottle; which, in order to make its exit must present one or the other of the ends of its long diameter, all other presentations, he said, demand the assistance of art. He, too, believed that the child willed to make its way head on into the outer world and for reasons not given, the turning from breech to head was consummated in the seventh month of gestation. Few, if any, questioned the authority of Hippocrates until the sixteenth century when Realdo Columbo, pupil and successor of Vesalius in the famous school of Padua, remarked sardonically, "babies do not jump around like monkeys."

* Read before the Central Association of Obstetricians and Gynecologists, Omaha, October 11, 1935.

Aetius of Amida lived in the sixth century A.D. and was called the "Founder of Midwifery." He, together with Paul, Celsus, Pliny and Oribasius formed a group of zealous compilers in the days when Rome was in the zenith of her power. Their works were veritable storehouses of historical data, much of which would otherwise have been lost. Aetius taught that birth takes place when the membranes become too small to retain the fetus, then the child tears the membranes and emerges through its own movements. Not content with crediting the baby with voluntary efforts in turning within the womb to extricate itself from its confines, he fancied the uterus cooperating with the baby. "For," said he, "it is moved of itself hither and thither in the flanks, also upward in a direct line to below the cartilage of the thorax; and also obliquely to the right or the left either to the liver or spleen; and it likewise is subject to prolapsus downward, and in a word is altogether erratic. It delights in fragrant smells, and advances towards them; and, it has an aversion to fetid smells, and flees from them; and, on the whole, the womb is like an animal within an animal."

The "Byrth of Mankynde," published by Richard Jonas in 1540, is an English translation of the Latin edition of "De Partu Homonis," and it in turn of the original German work by Rösslin, "The Rosegarten" which appeared in 1513. Translated into all languages of the continent and Great Britain, this remarkable little book remained for nearly two hundred years the sole printed work on midwifery. It marked the beginning of the pre-Renaissance of midwifery. While in no sense a scientific work it was something and that was all that the midwives, who dominated the practice of obstetrics, possessed by way of instruction, other than that obtained from their own personal experiences and works on surgery. In the "Byrth of Mankynde" we read, "If a child be so faint, weak and tender, that it cannot turn itself or doeth it very slowly . . . also if the child is dead in the mother's belly, it is a very perilous thing, for so much as it cannot be easily turned, neither can it help itself to come forth." Richard Jonas and before him Rösslin, were passing to future generations the age-old fallacy that the unborn child, unassisted by the expelling powers of the mother of which they had not the vaguest idea, was endowed physically and mentally with the essentials of birth. In this respect they had not advanced a whit beyond the concepts of primitive peoples.

There was little that was original in the "Midwives Books." While credit was withheld it is believed that much of their context was taken from the works of Moschion of about the sixth century and from Soranus of the second century A.D. In the many codices credited to ancient authorities, and to Soranus in particular, there are unique birth figures. In these crude illustrations we see the baby in all manner of grotesque attitudes, performing amazing acrobatic stunts. Many of them depicted not babies but adults of mature years. To the modern obstetrician these birth figures appear misbegotten and ridiculous but it must be borne in mind that the "Midwives Books" were written at the very threshhold of the science of obstetrics, at a time when there was much prejudice against the dissection of the human body. They probably originated in the early Christian era with Soranus, the leader of the sect known as the Methodists who scorned the study of anatomy. That Soranus was aware of the changing positions of the fetus in utero is apparent in the birth figures where we find not one but sometimes several babies tumbling over one another in the utmost confusion. These figures, in modified forms, appeared in works on obstetrics to the time of Mauriceau and Guillemeau in the seventeenth century and were borrowed without leave or ceremony by every author of a text on obstetrics to the time of Smellie. Verily, Soranus was the "best robbed man in all medical history."

If credit is due any one individual for the Renaissance of midwifery that man is Ambroise Paré. A military surgeon, and not an obstetrician, Paré, revived the ancient practice of turning. Endowed with a high degree of sagacity, and what we moderns call common sense, he was not immune to the whims and superstitions of his day. Paré believed in magic and witchcraft but did not subscribe to the belief of the ancients that monstrous babies were begotten by the devil. Having divested himself of his ancient vagary, he proceeded to commit himself to an equally absurd theory when he announced that the baby is endowed with an instinct that causes it to turn from a breech to a head presentation in the seventh month, and if born at that time it would have a better chance to survive than if born in the eighth month, when it would not have had time to recover from the exertion put forth in the act of turning.

Paré was giving expression to an ancient hypothesis for we have the word of Rhazes, the Arabian of the ninth century, a Galenist, albeit a disciple of Hippocrates, that an eight months baby had not so good a chance to survive delivery as did a seven months baby. Said he: "Before the seventh month the head of the foetus lies upward; after that it declines downward; the child needs time to recover from this exertion and so an eight month foetus is more apt to die than a seven months foetus."

The immortal Harvey, called by Aveling the "Father of British Midwifery," gave the following graphic description of the fetus in utero:

> He swimmeth in a water and moveth himself to and fro, he stretcheth himself now this way, and now that, and so is variously inflected and tumbled up and down, in so much as sometimes, being entangled in his own navel strings he is strangely ensnared . . . and the great bellied woman knows full well that she does sometimes acquire a different situation when she find the child kick sometimes above, sometimes below and now on the side and at other times on that.

Harvey clung to the age-old belief that the baby made its own way through a narrow passage to the outer world; that before the onset of labor the baby turned a somersault within the uterus, in order that the head might present at the portal of the womb, opening it by its own energies and thus struggling into day. Said he:

> Not only do birds break through their shells but all kinds of flies and butterflies pierce their delicate membranes in which they are encased; the silkworm softens by moistening and then eats through the silken bag, and wasps, hornets, and fishes of every kind are born by their own will power. . . . There is the fable of the young viper eating through the womb of its mother to avenge the death of its father, doing just what the young of every species does in breaking through the membranes which encase it.

To clinch his argument Harvey cited incidences of babies leaving the womb on their own power after the death of the mother.

William Smellie, perhaps the greatest of English obstetricians, opined that the baby does not turn a somersault, head on into the pelvis and his distinguished pupil, William Hunter, thought it absurd that the baby should be made to perform the tricks of a tumbler or rope dancer.

Foremost of the French obstetricians of the seventeenth century was Francis Mauriceau, of whom Levret remarked: "He drew from the cradle the art of midwifery." He was the first of that illustrious coterie of obstetricians, Peu, Portal, Guillemeau, Deventer, La Motte, Smellie, William Hunter and Levret, who marked the most brilliant epoch in the history of midwifery. Mauriceau professed belief in the voluntary evolution of the fetus and held that the birth of a dead baby was more difficult than that of a living one because it could not put forth the required exertion. Writing in the eighth edition of his "The Diseases of Women with Child and in Childbed etc.," he said:

> For the great endeavors often necessary to be used in turning the infant in the womb

(which is a little harder than to turn a pancake in a frying pan) does so weaken both mother and child, that there remains not afterward strength enough to commit the operation to the work of nature and usually the woman has no more throws nor pains fit for labour after she has been so wrought upon . . . the infant would certainly perish in the passage, without being able to be born.

John Maubray was England's first clinical instructor in obstetrics. Author of the "Female Physician" published in 1734, he expounded the mysteries of astrology, for Maubray believed that the planets guided the destinies of the mother and child. He believed in the magic of the number seven, that the seven planets have dominion over man from the moment of his conception. He agreed with "Learned and Curious Practisers in Midwifery" that birth always happens at the selfsame hour of the day or night in which the woman conceives and that this accounts for most births happening in the night or early dawn. He taught that an eight month's birth is always weak, if not half witted, but offered no explanation.

Mauquest de la Motte was a rural practitioner, living in Picardy at the tip of a French province that was almost surrounded by the sea. He was the last of the illustrious obstetricians of the seventeenth and eighteenth centuries (Mauriceau, Peu, Portal, Deventer, Siegemundin). With typical practicality de la Motte maintained that in the early months of pregnancy the baby is so small that it can assume almost any position in the mother's womb, but at a later time the position of the fetus is determined by the resistance of the walls of the uterus, as well as by the capacity of the uterus. Thus he foreshadowed the theory of accomodation. Having committed himself to this sensible conclusion, de la Motte wandered into the shadowy realm of fantasy when he said the child changes its position each time that it feels the need to do so and affirmed that the "spirals of the cord" exercise a controlling influence on the changing position of the baby.

Credit is given to de la Motte, Smellie and Baudelocque for having finally demolished the ancient fallacy of self determination on the part of the infant and for substituting the theory of gravitation. But this famous coterie of obstetricians were not to go unchallenged. John Burton of York, immortalized by Lawrence Sterne as Dr. Slop in Tristram Shandy, invented the forceps which Simpson said "worked like a lobster's claws" and contended that the baby turned near the hour of labor from a breech to a head, when with its back to the abdomen of the mother, the mother lying on her back, the baby seemed to creep into the world on its hands and knees.

In support of the theory of gravitation we read from the pen of Jean Astruc, in his six volume work on the diseases of women, published in Paris in 1761–1765:

> In this state, the infant has his head upwards and his feet towards the orifice of the uterus, with his face towards his mother's abdomen. During the first six months he remains in this situation, his head being towards his mother's navel, for his feet are, during that time, specifically heavier than the head; but this part begins at length to grow faster, in proportion, than any other; wherefore its superior weight turns the head downwards towards the orifice of the uterus, just as we see a ball of lead joined to a piece of cork, by its specifical weight to sink, whilst the cork floats on the surface, or keeps the superior parts. This change of situation of the infant is owing to the speedy growth of the brain. He is thus turned about fifteen days or three weeks before the delivery, which the midwives, nay, the mothers, perceive at that time, wherefore they say that the belly has then fallen.

Thomas Denman was one of England's greatest obstetricians. His "Introduction to the Practice of Midwifery," in the opinion of Herbert Spencer, is, the most splendid work on midwifery in the English language. Denman was first to give a detailed description of spontaneous version of the full term fetus and in recognizing the

possibility of a voluntary correction of a malposed fetus he counseled deliberation in the conduct of labor. "This," said he, "should certainly put us on our guard against hasty determinations, upon what is possible or otherwise, in any case; or upon the use of any means, which may be destructive to the child, or injurious to the mother." In commenting upon the ancient theory of spontaneous version at the seventh month Denman suggested that possibly the sponsors of this hypothesis feared that fatal consequences would result from the persistence of the fetus with its head downward for the full nine months of gestation.

Not to be outdone by his confreres and predecessors, who fixed the time of turning anywhere from the seventh month to the onset of labor, Velpeau contended that men forget that the fetus is doubled up in the amnios; that even at full term the child sometimes changes its position during labor; that the diameter passing from the occiput to the coccyx does not always exceed the length of the horizontal diameter of the womb.

Valpeau, writing in 1838, observed that "the different points of the foetus, though very remote from each other, may, during a labor, present alternately at the orifice; that positions of the back or shoulder may be converted into positions of the head or breast; that positions, in appearance the most unfavorable, might sometimes be replaced by normal positions, were all accoucheurs sufficiently well informed to know how to wait." Velpeau was strengthened in his faith in the corrective powers of nature by observing a spontaneous version of a shoulder presentation ten hours after the bag of waters had ruptured. He favored the gravitation theory and laid stress upon uterine contractions as a contributing factor, "It is," said he, "quite a natural phenomenon, easily explained by the action of the womb and its relation to the form of the ovum and foetus."

Tarnier would have none of the nonsense of the ancients who held to the fallacy of instinctive will of the fetus in turning. "The fetus," said he, "shut up in a closed sac, and constantly subjected to movement, must assume, not instinctively but mechanically, such a position as will bring its largest parts into correspondence with the most spacious portions of the organ." Tarnier was an exponent of the *theory of accommodation*.

Placing a dead fetus in a volume of water, Dubois observed that all parts descended with equal rapidity, and further observed that women lying in the prone position because of ill health, do not exhibit head presentations oftener than ambulatory cases. He reasoned that the laws of gravitation did not determine the position of the baby, nor did he believe that the fetus was suspended by the cord. The insertion of the cord nearer the pelvic extremity of the fetus cannot influence the position of the baby because the cord is longer than the longest diameter of the uterus. In his *theory of accommodation* Dubois was supported by Sir James Y. Simpson and Scanzoni, Pinard and Sellheim.

Mathews Duncan placed a baby, recently dead, in a bath of normal saline solution; the head sank to a lower level than the breech. Duncan reasoned that a similar process occurs in the amniotic fluid which accounts for the relative frequency of vertex presentations. His experiment with the saline solution was challenged by Schatz. It is known that the specific gravity of the amniotic fluid is lighter than that of a normal saline solution. Schatz placed a dead fetus in a solution of the same specific gravity as the amniotic fluid and the breech of the child sank below the level of the head. He then raised the specific gravity of the fluid and the head sank below the level of the breech. This, to Schatz, was conclusive evidence that gravitation alone will not account for the frequency of head presentations; that other factors must also be reckoned.

Turning to the more modern authorities we read that Schultze, Fasbender and P. Muller all made repeated observations on

the pregnant woman and observed that the baby turned, not once, but many times in the latter weeks of pregnancy. In a para 1, Muller relates that the baby turned six times in five days. Holing contended that the baby shifts its position with the changing attitude of the mother. He observed a woman in the erect position in whom the back of the baby presented on the right side and upon assuming a reclining position the back of the baby shifted to the left. More convincing evidence is that of Warnekros who demonstrated with *x*-ray studies that a vertex could be converted into a breech presentation by placing the woman in the Trendelenburg position, thereby reversing the act of gravitation.

To the theories of gravitation and accommodation may be added that proposed by Wigand, who said that the contractions of the uterus in late pregnancy "bring the baby into a convenient position." His theory was supported by Credé, Gonriet and Kristeller.

Modern authorities are generally agreed that gravitation is a factor to be considered in the early months of pregnancy, but in the last two months the process of accommodation between the fetal ovoid and the uterine cavity plays the important rôle in determining the ultimate position of the fetus. Nowhere in modern literature is mention made of voluntary evolution of the fetus.

The case which came under my observation presented a graphic picture of the mechanism of spontaneous version. The woman, a para v, aged forty years, was approaching full term when seen. Three doctors had examined her and could not agree on the diagnosis. Accordingly, a skiagraph showed the baby presenting by the breech (L.S.P.). The baby was of normal size, 7.5 lb. and there was no excess of amniotic fluid. For several weeks the patient had suffered pain in the right upper quadrant. Two days after the first skiagraph was taken there were violent movements of the baby; so great that the mother was thoroughly frightened. Then, she said, the uterus tightened and she felt something slip high on the right side. This was followed by a cessation of the fetal movements, a relaxation of the uterus and complete relief from pain in her right side. A second skiagraph revealed a vertex presentation (L.O.P.). She was delivered of a healthy baby within twenty-four hours.

The story told by the mother suggests that the baby initiated the act of turning and that the revolution was aided by the contractions of the uterus.

BOOK REVIEWS

A TREATISE ON MEDICAL JURISPRUDENCE. By Benton S. Oppenheimer, LL.B., LL.M., Professor of Law, College of Law, University of Cincinnati. Price, $4. Pp. 290. Baltimore: William Wood & Company, 1935.

Professor Oppenheimer's little volume would be more accurately entitled, "A Treatise on Certain Aspects of Medical Jurisprudence." It consists, the author tells us, of material originally gathered for a half dozen brief symposia which has "gradually grown into this volume," and which the author hopes may be helpful to "practicing physicians, nurses, social workers and lawyers." Of the 263 pages of reading matter in this book, the first 100 will prove of interest to physicians and surgeons; the chapter on Hospitals, pp. 217–227, might prove of interest to nurses; none of the book, in this reviewer's estimation, bears directly upon the problems of social workers; and the balance of the volume, covering approximately 150 pages, is a technical legal discussion of actions at law and admissibility of evidence, with full citation of cases, which may be "helpful to those lawyers who are occasionally required to deal with medico-legal problems."

It is to be hoped that in future editions the treatise will be re-written according to plan, as the importance of the subject deserves, and not just grow by putting cloth covers around a number of vaguely related lectures and law memoranda. There is little conceivable relation to the subject of medical jurisprudence in the discussion of "Dying Declarations," pp. 231–237. The final chapter, entitled "Miscellaneous," ends with a lengthy quotation from the Bulletin of the National Research Council. The discussion of admissibility of evidence belongs more appropriately in a legal journal. It quotes profusely from Wigmore on "Evidence," and adds nothing original to the legal subject of evidence. On the other hand, the first 100 pages of the book, devoted to the rights, obligations and privileges of the medical fraternity, is a well written, interesting discussion which every medical man may profitably read. This part of the book should be expanded. More particularly, the topic of the doctor in the courtroom should receive greater treatment than the four pages now allotted to it.

Successful trial lawyers, in cases involving medical aspects, explain to their medical witnesses just what the legal issues are and the limitations of legal proof in the case about to be tried. If the doctor in court, whether as fact witness or expert opinion witness, gives a bad account of himself, this reviewer believes that in almost every such case it is indicative of faulty preparation by the lawyer who calls him. If a doctor's temperament is such that he will not prepare himself adequately for court testimony, he should not be permitted to testify as an expert witness. All doctors testifying as fact witnesses should be warned to bring with them their records of treatment. This topic, with copious illustrations from actual court cases, should make interesting reading to the surgeon and physician.

The chapters on "Duties and Obligations of Physician to Patient," and on "Malpractice," are especially commended to the active medical practitioner.

A word of caution is necessary, with respect to certain forms advocated by the author as legally safe. This reviewer questions the adequacy of the form, on p. 227, for the release of information by a hospital, upon the request of the "nearest relative" of the patient, particularly information "pertaining to any form of venereal disease." A similar "relationship form" on p. 253, authorizing the performance of an autopsy upon a deceased relative, also throws the burden upon the pathologist of guessing correctly whether the relationship is legally adequate in each case. Similarly, the form on p. 40, which attempts to release in advance the operator of *x*-ray apparatus, is questionable. No hospital or doctor should rely upon any forms without consulting their own attorneys in each case.

THE DIAGNOSIS AND TREATMENT OF DISEASES OF THE PERIPHERAL ARTERIES. By Saul S. Samuels, A.M., M.D. New York, Oxford University Press, 1936.

This is an excellent monograph on an important subject. Dr. Samuels bases his study

on the results obtained during the past ten years, in the treatment of over 350 cases of thrombo-angiitis obliterans and of a large number of cases of peripheral arteriosclerosis.

The author says that the primary purpose of his monograph is to offer scientific proof of the fact that a "new viewpoint on the peripheral arterial diseases must be taken. The old idea that every case of thrombo-angiitis obliterans must sooner or later terminate in a series of amputations must be considered a relic of medieval surgery." With this in view the greatest stress is laid upon the minute details of treatment.

There is an ample Index.

To those whose work include the diseases of the peripheral arteries we recommend this book.

THE HUMAN FOOT. Its Evolution, Physiology and Functional Disorders. By Dudley J. Morton. New York, Columbia University Press, 1935.

This book plainly shows it was written by one with the proper scientific background to undertake a work of this kind. It is a book that those whose work in medicine embraces a consideration of the human foot, will do well to study carefully. Naturally, orthopedic surgeons will read it with interest and profit.

The author frankly states in his preface that an interest in this subject "naturally prompts a desire for further knowledge" and he hopes his work will "stimulate more active research in this field." The author further states, "Physiological study of foot ailments, as developed in the following pages, reveals the fact that the distribution of weight upon the different segments of the foot is of major importance. This constitutes a definite departure from the morphological basis of such studies now general, wherein changes in the foot's position or contour are considered the dominant feature. For physiological analysis has revealed certain structural factors whose influence in disorganizing the normal mechanism of the foot are clearly demonstable."

Part I, deals with The Evolutionary Development of the Human Foot: Part II, with The Physiology of the Human Foot: Part III, with The Functional Disorders of the Human Foot.

A bibliography has been purposely omitted, but for those who desire additional reading a list of reference and textbooks is given. There is an Index.

Subscribers to THE AMERICAN JOURNAL OF SURGERY *visiting New York City are invited to make the office of the publishers (The American Journal of Surgery, Inc., 49 West 45th Street, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices.*

AUTHOR INDEX TO VOLUME XXXII

Abeshouse, Benjamin S., 8
Aries, L. J., 176
Arnulf, G., 45
Aronsohn, Hans G., 18
Axelman, E. L., 308

Balfour, Donald C., 405
Bass, Hugh L., 241
Bate, John T., 180
Beck, Carl, 383
Berman, J. K., 541
Best, R. Russell, 381
Bird, Clarence E., 241
Bishop, E. L., 172
Bloom, Oscar H., 363
Bottone, John J., 154
Brav, Ernest A., 144
Brown, W. S., 499
Brunschwig, Alexander, 508
Bunch, George H., 519

Caldwell, John A., 522
Carmody, Morris G., 511
Charache, Herman, 530
Christopher, Frederick, 197
Clemmer, John J., 401
Clute, Howard M., 51
Connell, John N., 325

Davidson, Chester L., 146
Davison, T. C., 96
Delaney, C. Joseph, 277
Dickinson, Arthur M., 395
Dittrich, R. J., 533
Donaldson, H. H., 352
Donaldson, J. K., 139

Fairchild, Robert D., 126
Fellman, Morris, 467
Ferré, George, 163
Fetter, Theodore R., 371
Findley, Palmer, 545
Forrester, C. R. G., 1

Gartman, Edward, 371
Gaynor, Sidney S., 161
Gepfert, J. Randolph, 40
Gilbride, John J., 463
Glasser, S. Thomas, 63
Goff, C. W., 37
Goldberg, Samuel L., 478
Gorsch, R. V., 302, 483
Gottlieb, Mark J., 455
Grace, Edwin J., 105, 498
Griswold, R. A., 247
Gwathmey, James T., 411

Hamilton, Frank E., 357
Hamilton, G. Johnson, 435
Harbin, R. M., 298
Hardwick, Robert S., 4
Harris, I. B., 357
Heinz, Theodore E., 508
Hendon, G. A., 377
Henline, R. B., 222
Hobbs, William H., 258
Holder, Hall G., 544
Holding, Arthur F., 391, 393

Iason, Alfred H., 48
Ingram, David N., 366
Israel, George I., 369

Jacobs, J. Bay, 130
Johnson, Gertrude M., 113
Johnston, William M., 84
Jones, Thomas E., 511

Kaplan, Theodore, 318
King, H. Jackson, 135
Kiser, Edgar F., 188

Leriche, René, 45
Levis, William R., 308
Lieberman, William, 187
Linnehan, Edward H., 105
Lurje, A., 313
Lynch, Jerome M., 435

MacGuire, D. Philip, 77
Mahoney, Louis E., 272
Martin, Hayes E., 439
Mast, William H., 516
Mauterer, O. P., 178
Mayo, Charles W., 4
McLaughlin, Charles W., 524
McPeak, Edgar, 139
Mettenleiter, Michael W., 321
Miller, J. K., 527
Mooney, Voigt, 186
Moore, S. W., 222
Mora, J. M., 176

Norton, James F., 325
Nutt, John Joseph, 53

O'Connor, Gerald Brown, 445
Ormond, John K., 333
Orris, J. A., 343

Peters, George E., 357
Petersen, H. A., 291
Poer, D. Henry, 172
Pool, R. M., 469
Preusser, Walter F., 399

Rambar, Alwin C., 478
Ramsdell, Edwin G., 448
Rankin, J. O., 27
Reed, Jewett V., 79
Rees, Clarence E., 234
Rosenberg, Wm., 169
Rosenfeld, Samuel S., 103
Rubin, Herman, 150
Ruth, Henry S., 217

Sampolinski, A., 230
Senger, Fedor L., 154
Shaffer, James M., 197
Sharer, Robert F., 56
Siris, Irwin E., 277
Skemp, A. A., 166
Smead, Lewis F., 487
Sneierson, Hyman, 258
Soper, H. W., 90
Stella, Mario E., 373
Stern, Walter G., 179
Stiles, John A., 217

Taylor, William N., 335
Thomas, Henry Bascom, 108
Thompson, C. Edward, 524
Thompson, J. W., 90
Thorek, Max, 417
Thorp, Donald J., 538
Tilton, Benjamin T., 238
Tomaiuoli, Michele, 156
Travnicek, F. G., 166
Truesdale, P. E., 204

Vernon, Sidney, 100
Visconti, Joseph A., 376

Wangeman, C. P., 538
Waters, Edward G., 474
Wheeling, W. S., 343
Whitaker, Lester R., 379, 452
White, Richard Joseph, 347
Whyte, Ruthe, 439

Zechel, Gustav, 101, 324

SUBJECT INDEX TO VOLUME XXXII

(Bo.B.) = Bookshelf Browsing; (E.) = Editorial

Abdominal electrosurgery, descriptive terms for, 452
Aberrant lingual thyroid, 150
Abnormalities of rotation of midgut, 352
Acute appendicitis, 469
 dilatation of stomach, 131
 edema of vulva, 540
 intussusception in early weeks of life, 176
 osteomyelitis of patella, 373
 pancreatic necrosis, treatment of, 487
 puerperal inversion, 126
Adapter, proctoscope, for otoscope battery handles, 187
Adequate surgical masking: problem and solution, 474
Adrenal cortical carcinoma; hypertension, obesity, virilism and hirsutism, associated with, 347
Alcohol, sciatic neuralgia controlled by intraspinous (subarachnoid) injections of ethyl, 37
Alternative methods for restoring gastrointestinal continuity after gastric resection for carcinoma, 405
Amniotic fluid, intraperitoneal use of, to promote smoother postoperative convalescence, 40
Anesthesia, episiotomy under local, 100
 regional, 217
Anorectal fistula, 302
Appendicitis, acute, 469
 complicating pregnancy and labor, 325
 diverticulitis of ascending colon simulating acute, 376
Appendix, mucocele of, 511
Application of adhesive plaster, 324
Arteriography, renal, 222
Atelectasis, postoperative, 197
Atlas on axis, rotary dislocation of, 27
Autohemotransfusion in preventing postoperative lung complications, 321
Avulsion and evisceration of abdominal wounds, 63

Backache, postoperative; cause and management by improved hospital bed, 543
Benign bone cyst; localized in humerus, 126
Biopsy in proctology, 483
Bladder, foreign body in urinary, 178
 tumor, favorable effect of x-ray on unusual, 333
Bones and skeletal muscle, partial gigantism: overgrowth and asymmetry of, 108
Book Reviews:
 Clinical miscellany, Mary Imogene Basset Hospital, 193
 Diagnosis and treatment of diseases of the peripheral arteries (Samuels), 551
 Diagnostic roentgenology (Golden), 391
 Disease and destiny (Major), 194
 Early diagnosis of the acute abdomen (Cope), 194
 Human Foot (Morton), 552
 Practitioners Library of medicine and surgery, Vol. IX. Neurology and psychiatry, 391
 Radiology of bones and joints (Brailsford), 193
 Recent advances in cardiology (East and Bain), 193
 Textbook of sterilization (Underwood), 390
 Treatise on medical jurisprudence (Oppenheimer), 551
Bookshelf Browsing:
 Speculum Matricis by James Wolveridge, 188
 Spontaneous version at term, 549.
 Tobias Smollett, 383
Bowel, gallstone obstruction of, 166
Burn, ischemic necrosis from ice bag, 519

Calcified deposits in subscapularis tendon, 524
Cancer of pelvic colon and rectum, diagnosis and treatment of, 90
 rectum, 399
Carbuncle, treatment of, with short wave diathermy and cautery puncture, 467
Carcinoma, alternative methods for restoring gastrointestinal continuity after gastric resection for, 405
 hypertension, obesity, virilism and hirsutism associated with adrenal cortical, 347
 of colon and rectum, in operative mortality of "inoperable," 435
 mammary gland, edema of upper extremity in, 463
 stomach, spontaneous perforation of, 508
 uterus, modern treatment of, 395
Carotid artery, posttraumatic thrombosis of internal, 522
Cast, non-padded plaster, for lower extremity, 247
 suspension for leg, 186
Cecum, hemorrhagic infarction of, 357
Cholecystitis, delayed operation in acute, 241
 experimental studies of bacterial, 18
Cholelithiasis, etiology of, 291
Citizens only (E.), 195
Clamp, fascial suture, 546
 silver staple, 379
Colle's fracture, reversed: closed reduction, 161
Colon, diagnosis and treatment of cancer of pelvic, and rectum, 90
Contributing factors of peritoneal infection in closed incisions of abdomen, 298
Cutting prethyroid muscles for exposure in thyroidectomy, 51
Cyst, benign bone; localized in humerus, 126
 prolapse of rectum caused by extraperitoneal, of Wolffian body origin, 369

Decortication, subperitoneal, in gall-bladder disease, 77
Delayed operation in acute cholecystitis, 241
Descriptive terms for abdominal electrosurgery, 452
Diaphragmatic hernia, 204
Diagnosis and treatment of cancer of pelvic colon and rectum, 90
 ectopic (tubal) pregnancy, 84
Dilatation of stomach, acute, 135
Dislocation of neck, voluntary, 144
 rotary, of atlas on axis, 27
Distention, modern method for prevention of postoperative, 308
Diverticulitis of ascending colon simulating acute appendicitis, 376
Donors bureau for average hospital, organization of transfusion service and, 439

Ectopic (tubal) pregnancy, diagnosis and treatment of, 84
Edema of upper extremity in carcinoma of mammary gland, 463
 vulva, acute, 540
Editorial:
 Citizens only, 195
 Necessity for a chair of traumatic surgery in all medical schools, 1
 Tumor Clinic in general hospital, 391
Effect of head injury on hearing and orientation, 455

Electrosurgical obliteration of gall bladder without drainage, 417
Electrosurgery, descriptive terms for abdominal, 452
Epididymitis, vasectomy for prevention of, in prostatic surgery, 8
Episiotomy under local anesthesia, 100
Etiology of cholelithiasis, 291
Evipal soluble, rectal administration of, 411
Evisceration and avulsion of abdominal wounds, 63
Experimental studies of bacterial cholecystitis, 18

Fascia lata repair of sliding hernia, 48
Fascial suture clamp, 546
Fatalities in phrenic nerve surgery, 105
Favorable effect of *x*-ray on unusual bladder tumor, 333
Femur, fractures of shaft and neck, 277
Fibromyoma uteri, ninety-seven pound, 343
Fistula, anorectal, 302
Foreign body in urinary bladder, 178
Fracture dislocation of sacroiliac joint, 179
 reduction apparatus, portable, 180
 sternum, two interesting cases, 164
Fractures of shaft and neck of femur, 277
 skull, 448
Frost-bite, 318
Functions of mediotarsal joint, 53

Gall-bladder disease, subperitoneal decortication in, 77
Gall bladder, electrosurgical obliteration of, without drainage, 417
Gallstone obstruction of bowel, 166
 recurrent intestinal obstruction due to, 516
Ganglia, single incision, transabdominal, extraperitoneal approach to lumbar, 234
Gangrene of extremities, peripheral vascular disease with, 533
 lung, 139
Gas pains, prevention of, 272
Gastrointestinal continuity after gastric resection for carcinoma, alternative methods for restoring, 405
Glove flap method of dorsal hand repair, 445

Hand, glove flap method of dorsal, repair, 445
Head and neck, tumors of, 393
 injuries, treatment of acute, 79
 injury, effect on hearing and orientation, 455
Heart, metastatic tumors of, 527
Hemorrhagic infarction of cecum, 357
Hernia, diaphragmatic, 204
 fascia lata repair of sliding, 48
 repair of certain type of, 96
 strangulated inguinal, in premature infants, 478
 unilateral and bilateral, 4
Hirsutism, hypertension, obesity, virilism and, associated with adrenal cortical carcinoma, 347
Humerus, benign bone cyst localized in, 126
Hyperparathyroidism with von Recklinghausen's osteitis fibrosa cystica generalisata and hypopituitarism, 113
Hypertension, obesity, virilism and hirsutism associated with adrenal cortical carcinoma, 347
Hysterectomy, simplified local vaginal, 230

Importance of prickle cell layer in skin grafting, 498

Infants, stangulated inguinal hernias in premature, 478
Infarction of cecum, hemorrhagic, 357
Infection, contributing factors of peritoneal, in closed incisions of abdomen, 298
 of parotid gland, 258
Inguinal hernias, strangulated, in premature infants, 478
Injuries, treatment of acute head, 79
Intestinal needles, 377
 obstruction, recurrent, due to gallstone, 516
Intraligamentary injection of novocaine, treatment of sprains by, 45
Intraperitoneal use of amniotic fluid to promote smoother postoperative convalescence, 40
Intrascrotal lipoma, 154
Intraspinous (subarachnoid) injections, sciatic neuralgia controlled by, of ethyl alcohol, 37
Intussusception, acute, in early weeks of life, 176
Inversion, acute puerperal, 130
Ischemic necrosis from ice bag "burn," 519

Kidney pelvis and ureter, leukoplakia of, 335

Labor, appendicitis, complicating pregnancy and, 325
Leukoplakia of kidney pelvis and ureter, 335
Lingual thyroid, aberrant, 150
Lipoma, intrascrotal, 154
Low mortality of early operation for perforated gastric and duodenal ulcer, 238
Lumbar ganglia, single incision, transabdominal, extraperitoneal approach to, 234
Lung complications, autohemotransfusion in preventing postoperative, 321
 gangrene of, 139
Lymphomatosa, struma (Hashimoto), 172

Mammary gland, edema of upper extremity in carcinoma of, 463
Masking, adequate surgical: problem and solution, 474
Mediotarsal joint, functions of, 53
Mesenteric vascular occlusion, successful operation for, 499
Metabolism, protein, 313
Metastatic tumors of heart, 527
Midgut, abnormalities of rotation, 352
Modern method for prevention of postoperative distention, 308
 treatment of carcinoma of uterus, 395
Mucocele of appendix, 511
Muscle, partial gigantism: overgrowth and assymmetry of bones and skeletal, 108
Myxosarcoma of prostate, 169

Necessity for a chair of traumatic surgery in all medical schools (E.), 1
Neck and head, tumors of, 393
 voluntary dislocation of, 144
Necrosis, ischemic, from ice bag "burn," 519
 treatment of acute pancreatic, 487
Needles, intestinal, 377
Neuralgia, sciatic, controlled by intraspinous (subarachnoid) injections of ethyl alcohol, 37
Ninety-seven pound fibromyoma uteri, 343
Non-padded plaster cast for lower extremity, 247

Obesity, hypertension, virilism and hirsutism associated with adrenal cortical carcinoma, 347
Obstruction, gallstone, of bowel, 166
 recurrent intestinal, due to gallstone, 516
Operative mortality of "inoperable" carcinoma of colon and rectum, 435
Organization of transfusion service and blood donors bureau for average hospital, 439
Osteitis fibrosa cystica generalisata and hypopituitarism, hyperparathyroidism with von Recklinghausen's, 113
Osteomyelitis, acute, of patella, 373

Pancreatic congestion limited to caudad portion, 163
necrosis, treatment of acute, 487
Parotid gland, infection of, 258
Partial gigantism: overgrowth and asymmetry of bones and skeletal muscle, 108
Patella, acute osteomyelitis of, 373
Pathologist, tumor clinic and, 401
Penis, traumatic rupture of, 371
Perforation of carcinoma of stomach, spontaneous, 508
Peripheral vascular disease, with gangrene of extremities, 533
Peritoneal sutures in Narath and Schönbauer's modification of Talma's operation, 101
Phrenic nerve surgery, fatalities in, 105
Placenta accreta, 156
Podalic version, 103
Portable fracture reduction apparatus, 180
Postoperative atelectasis, 197
backache; cause and management by improved hospital bed, 543
Posttraumatic thrombosis of internal carotid artery, 522
Pregnancy, appendicitis complicating, and labor, 325
Prethyroid muscles, cutting, for exposure in thyroidectomy, 51
Prevention of gas pains, 272
Prickle cell layer in skin grafting, importance of, 498
Proctology, biopsy in, 483
Proctoscope adapter for otoscope battery handles, 187
Proctoscopic attachment for operating table, 381
Prolapse of rectum caused by extraperitoneal cyst of Wolffian body origin, 369
Prostate, myxosarcoma of, 169
Prostatic surgery, vasectomy for prevention of epididymitis in, 8
Protein metabolism, 313

Rectal administration of evipal soluble, 411
Rectum, cancer of, 399
diagnosis and treatment of cancer of pelvic colon and rectum, 90
operative mortality of "inoperable" carcinoma of colon and, 435
prolapse of, caused by extraperitoneal cyst of Wolffian body origin, 369
Recurrent intestinal obstruction due to gallstone, 516
Regional anesthesia, 217
Renal arteriography, 222
Repair, glove flap method of dorsal hand, 445
of certain type of hernia, 96
Reversed Colles fracture: closed reduction, 161
Rhabdomyosarcoma of thigh, traumatic, 530
Rotary dislocation of atlas on axis, 27
Rotation of midgut, abnormalities of, 352
Rupture of penis, traumatic, 371
uterus, spontaneous, 363

Sacroiliac joint, fracture dislocation of, 179
Sciatic neuralgia controlled by intraspinous (subarachnoid) injections of ethyl alcohol, 37
Silver staple clamp, 379
Simplified local vaginal hysterectomy, 230
Single incision, transabdominal, extraperitoneal approach to lumbar ganglia, 234
Skin grafting, importance of prickle cell layer in, 498
Skull fractures, 448
Smollett, Tobias (Bo.B.), 383
Speculum Matricis by James Wolveridge (Bo.B.), 188
Spontaneous perforation of carcinoma of stomach, 508
rupture of uterus, 363
version at term (Bo.B.), 549
Sprains, treatment of, by intraligamentary injection of novocaine, 45
Sternum, two interesting cases of fracture of, 164
Stomach, acute dilatation of, 135
spontaneous perforation of carcinoma of, 508
Strangulated inguinal hernias, in premature infants, 478
Struma lymphomatosa (Hashimoto), 172
Subperitoneal decortication in gall-bladder disease, 77
Subscapularis tendon, calcified deposits in, 524
Substernal thyroid, 56
Successful operation for mesenteric vascular occlusion, 499
Surgical masking, adequate: problem and solution, 474
Suspension for leg casts, 186
Suture clamp, fascial, 546

Talma's operation, peritoneal sutures in Narath and Schönbauer's modification of, 101
Thigh, traumatic rhabdomyosarcoma of, 530
Thrombosis of internal carotid artery, posttraumatic, 522
Thyroid, aberrant lingual, 150
substernal, 56
Thyroidectomy, cutting prethyroid muscles for exposure in, 51
Tobias Smollett (Bo.B.), 383
Transfusion service and blood donors bureau for aver[illegible], 439
Traumatic [illegible] 530
rupture of penis, 371
surgery, necessity for a chair of, in all medical schools (E.), 1
Treatment of acute head injuries, 79
pancreatic necrosis, 487
cancer of pelvic colon and rectum, diagnosis and, 90
carbuncle with short wave diathermy and cautery puncture, 467
ectopic (tubal) pregnancy, diagnosis and, 84
sprains by interligamentary injection of novocaine, 45
Tumor clinic and pathologist, 401
in general hospital (E.), 391
favorable effect of x-ray on unusual bladder, 333
Tumors of head and neck, 393
heart, metastatic, 527
Two interesting cases of fracture of sternum, 164

Ulcer, low mortality of early operation for perforated gastric and duodenal, 238
Unilateral and bilateral hernia, 4
Upper extremity, edema, in carcinoma of mammary gland, 463
Ureter, leukoplakia of kidney pelvis and, 335
Uterus, modern treatment of carcinoma of, 395
spontaneous rupture of, 363

Vaginal hysterectomy, simplified local, 230
Vascular disease, peripheral, with gangrene of extremities, 533
occlusion, successful operation for mesenteric, 499
Vasectomy for prevention of epididymitis in prostatic surgery, 8
Version, spontaneous, at term, (Bo.B.), 549
Virilism, hypertension, obesity and hirsutism associated with adrenal cortical carcinoma, 347
Voluntary dislocation of neck, 144
Vulva, acute edema of, 540

Wilm's tumor, 366
Wounds, evisceration and avulsion of abdominal, 63

X-ray, favorable effect of, on unusual bladder tumor, 333